Volume I, No. 6 JUNE, 1919 Old Series, Vol. XVII, No. 6

GENERAL LIBRARY
JUN 4 1919
UNIV. OF MICH.

The Journal of Orthopædic Surgery

The Official Publication of the
American Orthopedic Association
and of the
British Orthopædic Association

ISSUED MONTHLY
FOUR DOLLARS PER ANNUM

126 MASSACHUSETTS AVENUE
BOSTON, MASS., U.S.A.

For the
British Orthopædic Association

Editor
R. C. ELMSLIE, M.S., F.R.C.S.

Editorial Committee
T. R. ARMOUR, F.R.C.S.
W. H. TRETHOWAN, F.R.C.S.
H. PLATT, M.S., F.R.C.S.

For the
American Orthopedic Association

Editorial Committee
C. F. PAINTER, M.D.
ALBERT H. FREIBERG, M.D.
DAVID SILVER, M.D.

CONTENTS

FRONTISPIECE. DR. H. AUGUSTUS WILSON, 1853-1919.

THE NON-OPERATIVE TREATMENT OF NERVE LESIONS INVOLVING THE UPPER EXTREMITY. By T. E. Hammond, F.R.C.S., Cardiff, Wales.

STIFF FINGERS: WITH SPECIAL REFERENCE TO METHODS OF TREATMENT BY METAL AND PLASTER SPLINTS.
By P. Jenner Verrall, M.B., B.C., F.R.C.S., London, England.

AN OPERATION FOR THE PERMANENT CORRECTION OF WEAK FEET IN CHILDREN. By Charles Ogilvy, B.A., M.D., F.A.C.S., New York City.

THE TREATMENT OF JOINTS STIFFENED BY WAR INJURIES.
By Captain Mitchell Langworthy, M.C., U.S.A.

A SURVEY OF THE ORTHOPAEDIC SERVICES IN THE U. S. ARMY HOSPITALS, GENERAL, BASE, AND DEBARKATION.
By Lieut.-Col. Robert B. Osgood, M.C., Boston.

ROBERT LINDER

Manufacturer of

Orthopedic Appliances

Hip Splints, Arm Splints, Knee Splints,
Bow-Leg Braces, Knock-Knee Braces,
Spine and Shoulder Braces,
and Flat-Foot Soles

ELASTIC STOCKINGS and TRUSSES
of every description

No. 148 East 53d Street, New York

The Journal of Orthopædic Surgery

The Official Publication of the American Orthopedic Association and of the British Orthopaedic Association.

For the British Orthopaedic Association

Editor,—R. C. Elmslie, M.S., F.R.C.S., 1a, Portland Place, London, W. 1.

Committee,—

T. R. Armour, F.R.C.S.,
W. F. Trethowan, F.R.C.S.,
H. Platt, M.S., F.R.C.S.

For the American Orthopedic Association

Committee,—

C. F. Painter, M.D.,
Albert H. Freiberg, M.D.,
David Silver, M.D.

PUBLISHED ON THE FIFTH DAY OF EACH MONTH BY

ERNEST GREGORY, 126 MASSACHUSETTS AVE., BOSTON, MASS., U. S. A.

Entered as Second Class Matter in the Post Office at Boston, Massachusetts

Vol. I, No. 6 JUNE, 1919 Old Series: Vol. xvii, No. 6

TABLE OF CONTENTS

Frontispiece. Dr. H. Augustus Wilson, 1853-1919. 319

The Non-Operative Treatment of Nerve Lesions Involving the Upper Extremity. *By T. E. Hammond, F.R.C.S.*, Cardiff, Wales. 320

Stiff Fingers: with Special Reference to Methods of Treatment by Metal and Plaster Splints. *By P. Jenner Verrall, M.B., B.C., F.R.C.S.*, London, England. 335

Discussion of Papers by T. E. Hammond and P. Jenner Verrall. 342

An Operation for the Permanent Correction of Weak Feet in Children. *By Charles Ogilvy, B.A., M.D., F.A.C.S.*, New York City. 343

The Treatment of Joints Stiffened by War Injuries. *By Mitchell Langworthy, Captain, M.C., U.S.A.* 349

A Survey of the Orthopædic Services in the U. S. Army Hospitals, General, Base, and Debarkation. *By Robert B. Osgood, Lieut.-Colonel, M.C.* 359

Book Reviews. 383

Orthopædic Society Meeting. 387

Current Orthopædic Literature. 389

ORIGINAL ARTICLES.—Papers for publication will be accepted only for exclusive publication in this Journal. Papers in foreign languages will be accepted and translated without charge, if suitable for publication. The American Orthopedic Association and the British Orthopædic Association do not officially endorse the opinions presented in the different papers published in this Journal.

Papers for publication and all other communications for the Editorial Department should be addressed in England to R. C. Elmslie, M.S., F.R.C.S., 1a, Portland Place, London, W. 1; in America to Miss Hannah Lissner, 372 Marlborough St., Boston, Mass.

CURRENT ORTHOPÆDIC LITERATURE.—Contributions for this department should be sent to Miss Hannah Lissner, 372 Marlborough St., Boston, Mass.

REFUSED MANUSCRIPTS will be returned provided stamps are forwarded for that purpose.

ADVERTISEMENTS.—Advertising forms go to press on the fifth of the month preceding the month of issue. Advertising rates will be furnished on application.

CHANGE OF ADDRESS.—When address is to be changed, both the old and new addresses should be given.

THE SUBSCRIPTION PRICE of this Journal is $4.00 per year, in advance, postage prepaid for the United States and Mexico; the equivalent of $4.50, or 18 shillings, for all foreign countries included in the postal union. Canada, $4.25. Single copies, 40 cents.

All communications concerning subscription and advertising should be addressed to the Publisher, and all checks, drafts and post-office orders should be made payable to

THE JOURNAL OF ORTHOPAEDIC SURGERY,
126 Massachusetts Avenue, Boston, Mass., U. S. A.

Athenia Corsets

for

Spinal and Abdominal Support

Made on natural lines to fit the average normal figure. Designed with the help and advice of eminent physicians to give support to the natural curve of the spine and abdomen without pressure at the waist or diaphragm.

As no corset will fit every figure, adjustments and alterations are often necessary and should be made under our supervision. For cases where this is impossible, we have prepared careful directions to insure proper fitting.

MANUFACTURED AND SOLD AT

Chandler's Corset Store

Established 1897

50 Temple Place **Boston**

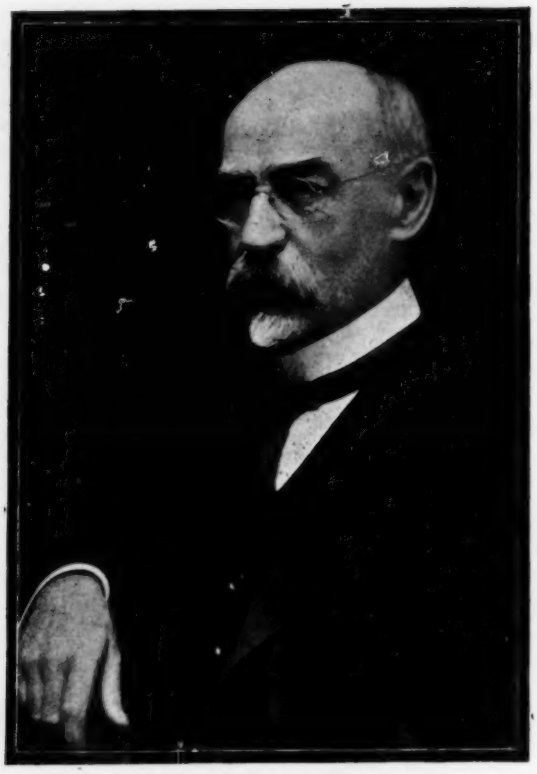
A
Rational Procedure
in
Summer Diarrhea

For Infants of any age

Mellin's Food
4 level tablespoonfuls
Water (boiled, then cooled)
16 fluidounces

Give one to three ounces every hour or two, according to the age of the baby, continuing until stools lessen in number and improve in character.

Milk, preferably skimmed, may then be substituted for water—one ounce each day—until regular proportions of milk and water, adapted to the age of the baby, are reached.



H. Augustus Wilson
1853–1919

Vol. I, No. 6 JUNE, 1919 Old Series: Vol. xvii, No. 6

The Journal of Orthopædic Surgery

DR. H. AUGUSTUS WILSON.

Dr. H. Augustus Wilson, a former president of the American Orthopedic Association, died in Philadelphia on April 16, 1919, after an illness of two days.

Dr. Wilson was born in Philadelphia September 4, 1853. After a preparatory education in the public and private schools of Philadelphia, he entered Jefferson Medical College, graduating in 1879, and in 1894 Ursinus College conferred upon him the degree of A.M., for distinguished services in the cause of education. In 1885, Dr. Wilson was made Professor of Mechanical Surgery at the Philadelphia Polyclinic, a title which was later changed to Professor of General and Orthopedic Surgery. Since 1897 he has been Emeritus Professor of Orthopedic Surgery. In 1889, as Clinical Professor of Orthopedic Surgery, he delivered the first course of lectures on orthopedic surgery ever given in the Woman's Medical College. In 1904, Dr. Wilson was appointed Professor of Orthopedic Surgery in Jefferson Medical College, a position which he resigned on the thirty-ninth anniversary of his graduation, in 1918, since which time he had been Emeritus Professor.

Dr. Wilson became a member of the American Orthopedic Association in 1891 and has always been an active worker. He has served on the Editorial Committee, the Executive Committee, and the Membership Committee, was First Vice-President in 1893 and President of the Association in 1901. He had also been made chairman of the Committee of Arrangements for the Annual Meeting of the Association which is to be held this month in Atlantic City.

Dr. Wilson will be greatly missed at the meetings of the Association, of which he had been for so many years a devoted member.

THE NON-OPERATIVE TREATMENT OF NERVE LESIONS INVOLVING THE UPPER EXTREMITY.*

BY T. E. HAMMOND, F.R.C.S., CARDIFF, WALES.

THIS subject will be discussed under two headings:

1. Cases in which adhesions are absent and paralysis alone exists.
2. Cases in which adhesions are present causing,
   - *a.* Limitation of flexion.
   - *b.* Limitation of extension.
   - *c.* Limitation of flexion and extension.

THE TREATMENT OF NERVE LESIONS IN WHICH ADHESIONS ARE ABSENT.

The relaxation of paralyzed muscles, a principle for which we are indebted to General Sir Robert Jones, forms the most essential part in the treatment of all nerve injuries. Unless this is properly carried out, all other forms of treatment are of diminished value. There is one position in which all muscles, ligaments, and tendons are relaxed, the position of physiological rest, which is taken up by the body when at ease.

The Position of Physiological Rest.

The upper extremity is suspended from the body by muscles and ligaments. In the upright position these muscles and ligaments support the whole weight of the arm. Any position which takes part of the weight, and so lessens the strain on the muscles, is taken up as the position of rest; the hands may be kept in the pockets, the lower margins of which support the arm; the soldier supports the arms on his rifle. When no such accessories are present, the position of ease is that shown in Fig. 1.

The forearm rests on the prominence formed by the great trochanter and its attached muscles, which takes part of the weight of the arm. and so lessens the strain on the shoulder muscles.

The elbow is flexed at 120°.

The shoulder is abducted 15° and inwardly rotated. This abduction is masked by the flexion of the elbow and the internal rotation. If the elbow be extended with the thumbs pointing forwards, the angle of abduction becomes evident.

The hands are held midway between pronation and supination to lessen the effect of gravity on the fingers. The wrist is dorsi-flexed 45°,

* A paper read before the British Orthopædic Association, July 26, 1918.

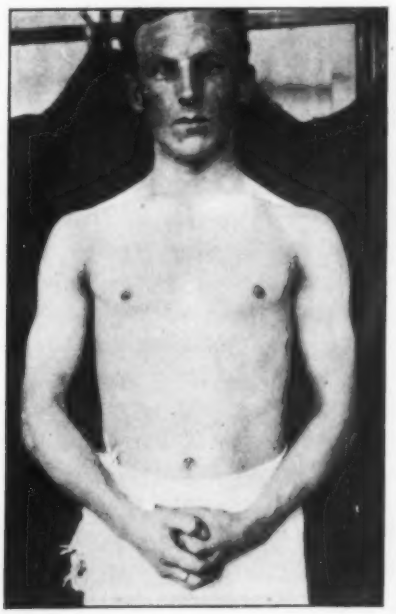


FIG. 1.—To show position of physiological rest.

FIG. 2.—To show position of hand when at rest.

with the fingers flexed 20° at the metacarpo and mid-phalangeal joints and 5° at the distal. The thumb is abducted 30° in a plane at right angles to the palm and is flexed at 20° at both the metacarpo- and inter-phalangeal joints. With the hand in this position the plane of the anterior surface of the forearm passes half an inch below the tips of the fingers, and a line continuing forwards to the radial border of the forearm passes longitudinally through the thumb (Fig. 2).

Four arches are present, the proximal and distal transverse, and the inner and outer longitudinal: The proximal arch, situated at the level of the carpo-metacarpal articulations, is formed by both rows of carpal bones and the bases of the metacarpals. It has a dorsal convexity most prominent at the junction of the third metacarpal and os magnum, and is maintained by the carpo-metacarpal and anterior annular ligaments and the tone of the thenar and hypothenar muscles. Upon this arch the force of flexion of the thumb depends. The distal arch, formed by the heads of the metacarpals, is most prominent over that of the third. It is maintained by the palmar aponeurosis and transverse metacarpal ligaments, and the tone of the interossei, lumbricals and flexors. Upon this arch depends the force of flexion of the fingers. It is continued forward to the tips of the fingers. The hollow in the centre of the palm is not an independent arch, but is formed by the thenar and hypothenar eminences.

The outer arch is formed by the thumb and outer portion of the carpus. Starting at the scaphoid, it passes forwards and laterally to the head of the metacarpal and then forwards and medially to the tip of the thumb, with the summit over the head of the metacarpal and a secondary curve over the interphalangeal joint. It is maintained by the tone of the long flexor and small muscles of the thumb and the anterior and lateral ligaments of the joints.

The inner arch, formed by the inner portion of the carpus and the four inner metacarpals and phalanges, begins at the carpal bones and passes forwards and upwards to the heads of the metacarpals, and then downwards and forwards to the tips of the fingers, with the summit over the heads of the metacarpals and secondary curves over the interphalangeal joints. It is maintained by the tone of the interossei, lumbricals, and flexors, by the palmar aponeurosis, and the anterior and lateral ligaments of the joints.

This position of physiological rest corresponds to the position of relaxation and is practically constant for the hand. Slight variations may occur at the shoulder and elbow according to the position of the point of support.

The Mechanism for Maintaining the Position of Physiological Rest.

This position is maintained by muscle tone, by which is meant a slight, continuous, involuntary contraction, dependent on a reflex arc with a centre in the cord, and afferent fibres from the ligaments and tendons, and efferent fibres to the muscles.

This tone keeps the muscle under slight tension, so that on receipt

of an impulse immediate contraction takes place. Were the muscle not under tension, delay would occur in taking up the "slack." At the same time it prevents the muscles and ligaments from being stretched and counteracts the influence of gravity.

When a position other than that of physiological rest is taken up during sleep, one group of muscles and ligaments is stretched. From the latter, stimuli pass to the centre calling for increased tone in the stretched muscles, and, when no resistance is present, the position of rest is resumed.

When a nerve is divided, the reflex arc is destroyed and muscle tone is lost. Stretching of one group of muscles and ligaments occurs owing to the unopposed tone in the opposite group, and, unless these stretched structures are relaxed, degeneration follows.

The Relaxation of Muscle.

By relaxation is meant the placing of a muscle in its normal position of rest, so that no strain is thrown upon it.

In relaxing paralyzed muscles, stretching of the opposing group must be avoided. Were slight stretching of muscles and ligaments to occur, the muscles by their elasticity would elongate considerably, so that no strain is thrown upon their attachments. The ligaments are practically inelastic, and strain at their attachments develops. Were this position to be maintained in the normal hand for some time, the stretching of the muscles would give rise to paresis, the chronic strain on the ligaments to chronic inflammation and adhesions. In nerve lesions the nutrition of the tissues is impaired, and paresis and adhesions follow the slightest strain. In the case of powerful muscles associated with the grosser movements, the paresis is of little consequence and soon disappears. In the case of the joints and muscles of the hand, where accurate and finely co-ordinated movements are essential, the slightest paresis and adhesions markedly impair its function. Therefore, not only must the paralyzed muscles and ligaments be relaxed, but at the same time it is equally essential that stretching of the opposing group does not occur.

In the position of physiological rest all muscles, tendons, and ligaments are relaxed. This is shown by the fact that it is the position taken up during ease and sleep, and that it can be maintained for a prolonged period without the slightest discomfort or fatigue. Any other position of the normal hand can only be maintained by slight voluntary contraction or passive force, and would be associated with hyper-relaxation of one group of muscles and ligaments and stretching of the opposing group.

Were the hand to be kept in the position of rest for several weeks, no discomfort would occur, and on removal of the splint full forcible contraction of the muscles could immediately take place. This shows that no strain has been placed on any structure, and can be said of no other position of the hand.

Extension of the fingers beyond this position causes an ill-defined feeling of tension over the anterior aspects of the joints, which passes into the forearm when the wrist is dorsi-flexed; this is due to stretching of the ligaments in the former and of the muscles in addition in the latter. A similar condition is present on flexing the fingers and wrist. Were the normal hand to be kept in either of these positions for several weeks, a dull aching pain would be present, and, on removal of the splint, slight paresis due to stretching of the ligaments and muscles. Hyper-relaxation of one group of muscles and ligaments has occurred, but only by stretching the opposing group.

There is consequently only one position in which paralyzed muscles can be placed without stretching the opposing group, the position of physiological rest.

It is stated that, as normal muscles are under slight tension in the position of rest, paralyzed muscles should be hyper-relaxed. This tension is present in a normal muscle, whether it is relaxed, hyper-relaxed, or stretched. This is seen when the quadriceps is divided during amputations through the thigh, retraction of the muscle occurring as soon as it is divided, whether the knee is flexed 30 (position of relaxation), fully extended (position of hyper-relaxation), or flexed to 90 (position of stretching). This tension is entirely dependent on muscle tone and disappears as soon as this is lost. Under a spinal anaesthetic the peripheral reflex arc is temporarily abolished and muscle tone is lost; in amputations through the thigh, division of the quadriceps is not now followed by retraction unless in the position of stretching.

Hyper-relaxation does not produce quicker recovery of power in paralyzed muscles than true relaxation. On the other hand, it is much more harmful, as it stretches the opposing muscles and ligaments and gives rise to paresis and adhesions. Adhesions forming after paralyzed muscles have been relaxed are due to the fact that hyper- and not true relaxation has been produced.

The Application of the Principle of Relaxation to the Hand.

In the position of rest the ligaments are slightly slack, more so on the dorsal than on the palmar aspect, and but little deviation from this position is possible without strain on their attachments. The muscles

control accurate and finely co-ordinated movements. Under no condition should the slightest stretching of these muscles and ligaments occur. The hand should always be placed in the position of physiological rest in lesions of the musculo-spiral, median, or ulnar nerves, the arches being carefully preserved in all cases.

In musculo-spiral lesions the wrist has been dorsi-flexed to 60° with the fingers almost fully extended to relax the extensors; in ulnar lesions the fingers have been flexed at 90° at the metacarpo-, and extended at the interphalangeal joints to relax the lumbricals and interossei, and in some cases the wrist is palmar flexed 45° to relax the flexors; in lesions of the median the two outer fingers have been flexed 90° at the metacarpo- and fully extended at the interphalangeal joints to relax the lumbricals, with the wrist flexed 45° to relax the flexors. In all cases hyper-relaxation of the paralyzed muscles has occurred and adhesions have formed in most cases. Such positions must, therefore, be condemned.

The Application of Relaxation in Paralysis of the Deltoid.

The shoulder in the position of rest is abducted 15°, and the humerus is maintained in contact with the glenoid by the tone of the shoulder muscles, particularly by that of the deltoid. With paralysis of the deltoid, the arm is adducted and falls away from the side, and in long standing cases there may be as much as one-fourth inch lengthening of the arm. To maintain the arm in the position of rest not only must it be abducted 15°, but at the same time the humerus must be held in contact with the glenoid. An apparatus to maintain this position would be complicated and apt to get out of order. Abduction of the arm to 80°, recommended by Sir Robert Jones, not only produces the necessary abduction, but at the same time the tone of the pectoral and upper scapular muscles keep the humerus in contact with the glenoid. In this position the deltoid is hyper-relaxed, and stretching of the opposing muscles occurs. These are powerful muscles which contract with gravity and control gross movements, consequently any paresis soon passes off. The lower margin of the capsule is exceedingly loose, and with abduction to 80° no strain is thrown on its attachments and adhesions do not form.

This position can be easily maintained by the abduction splint, introduced by Sir Robert Jones.

Methods of Maintaining the Hand in the Position of Rest.

This is carried out by splints and strapping, for the application of which a knowledge of the creases of the hand is essential.

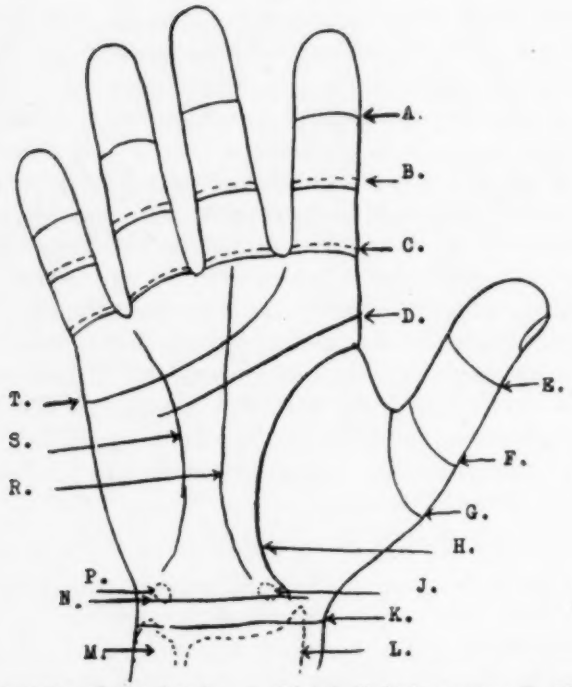


FIG. 3.—The creases of the hand. *A*, Distal digital crease; *B*, Middle digital crease; *C*, Proximal digital crease; *D*, Inner transverse crease; *E*, Distal thumb crease; *F*, Middle thumb crease; *G*, Proximal thumb crease; *H*, Thenar crease; *J*, Tubercle of scaphoid; *K*, Proximal wrist crease; *L*, Radius; *M*. Ulna; *N*, Distal wrist crease; *P*, Pisiform; *R*, Middle palmar crease; *S*, Hypothenar crease; *T*, Inner palmer crease.

a. The Creases of the Hand. On the front of the wrist two creases are present, the proximal corresponding to the level of the radio-carpal, the distal to the inter-carpal joint.

The thenar crease, commencing externally to the tubercle of the scaphoid, passes forwards and outwards to join the outer border of the hand one inch below the base of the forefinger, and corresponds to the inner border of the thenar muscles. A splint, to allow full movement of the thumb, must have its outer border internal to the thenar crease.

The transverse crease is situated over the distal portion of the palm. The outer portion commences distal to the thenar crease, and passes backwards and inwards to fade away over the hypothenar eminence. The inner begins one inch below the little finger, and passes forwards and outwards towards the cleft between the index and middle fingers. This crease corresponds to the base of the phalanges on full flexion of

the fingers. A splint to allow full flexion of the fingers should not extend beyond a line joining the outer and inner borders of this crease.

The hypothenar crease, very indistinct, commences externally to the pisiform, and passes forwards to fade away over the base of the little finger. It corresponds to the outer margin of the hypo-thenar muscles.

The middle palmar crease begins over the tubercle of the scaphoid, and passes forwards to fade away over the base of the middle finger. It corresponds to the summit of the transverse arch of the palm, and should represent the long axis of the long and short cock-up splints.

The proximal digital crease corresponds to the line of contact of the fingers and palm on full flexion and is of no importance.

The lower of the middle digital creases corresponds to the line of flexion of the proximal phalangeal joint and to the proximal secondary curve on the inner arch.

The distal digital crease corresponds to the line of flexion of the terminal phalangeal joint and to the distal secondary curve.

The proximal thumb crease corresponds to the anterior edge of the base at the first phalanx on full flexion and to the summit of the outer longitudinal arch.

The middle thumb crease is of no importance.

The distal thumb crease corresponds to the interphalangeal joint and to the secondary curve on the outer arch.

b. The Long Cock-up Splint. This consists of two pieces, one for the forearm, the other for the hand.

The forearm piece, grooved from side to side so that no pressure is exerted on the muscles, extends forwards to the distal wrist crease.

The hand piece, dorsi-flexed 45°, is firmly united to the forearm piece, the line of junction being slightly rounded to fit the wrist. There are two segments, one for the fingers, the other for the thumb.

The border of the finger piece passes forwards and inwards to the scaphoid, and then forwards and outwards, internally to the thenar crease, to reach the outer border of the hand at the same level. It now proceeds forwards, inwards, and backwards to join the inner border of the forearm piece. It should be curved in its long axis to fit the inner arch with secondary curves at the transverse and middle and distal digital creases to correspond to the normal flexion at the corresponding joints. At the level of the distal wrist crease there is a central transverse curve to fit the proximal arch with hollows on each side to take the prominences of the scaphoid and pisiform. This transverse curve is continued forwards to the tips of the fingers, the middle

FIG. 4.—To illustrate relation of short "cock-up" splint to the creases of the hand.

crease and finger forming the summit. The inner of the two hollows is continued forwards to take the hypothenar eminence, the outer being continued into the thumb piece.

The thumb piece is attached to the finger piece in the line of the thenar crease, and is abducted 30° in a plane at right angles. It should be grooved at the base to take the thenar eminence, and is curved in its long axis with the summit opposite the proximal thumb crease, and a smaller secondary curve opposite the distal crease.

If this splint were applied to a hand the muscles of which were paralyzed, the long and transverse arches would be preserved, no pressure would be present on the thenar and hypothenar eminences, and the thumb would be held in its normal position. There would be no stretching of any structure, the hand being held in the position of rest.

c. The Short Cock-up Splint. The forearm piece is not quite so long. The hand piece is dorsi-flexed 45°. The outer border of the hand piece passes forwards and inwards externally to the tubercle

FIG. 5.—To show splint *in situ*

FIG. 6.—To illustrate full flexion of the fingers.

of the scaphoid to reach the thenar crease. It then passes forwards internally to this crease in the direction of the cleft between the fore and middle fingers, but just proximal to the transverse crease turns inwards. Reaching the hypothenar crease, it passes backwards externally to this crease until the base of the hypothenar eminence is reached, when it passes obliquely inwards to become continuous with the forearm piece.

There should be a dorsal convexity to fit the proximal arch, with a small hollow on each side to take the tubercle of the scaphoid and the pisiform.

This splint allows full flexion of the fingers and thumb, supports the arches of the hand, and no pressure is exerted on the thenar and hypothenar muscles (Figs. 4, 5, 6).

When fibrous adhesions are present in the wrist joint, a slightly wider splint is advisable.

d. The Application of Strapping. To maintain the distal arch the strapping should be applied on a level with the transverse crease, the hand being in the position of physiological rest with the arch re-formed.

In the case of the proximal arch it crosses the first metacarpal at

the junction of the middle and lower thirds and the inner border of the hand just above the pisiform, the thumb being abducted 30° and the proximal arch well formed.

The Application of These Methods to the Individual Nerve Lesions.

In lesions of the musculo-spiral, drop-wrist with slight flexion of the fingers is present. The hand should be placed on a long cock-up splint with the long and transverse arches carefully preserved.

In lesions of the ulnar, the fingers are hyper-extended at the meta-carpo- and slightly flexed at the inter-phalangeal joints. Marked flattening of the distal arch is present. The hand should be placed in the position of rest with the transverse arch well formed. As a rule strapping to support this arch and a small cock-up splint are alone required.

In lesions of the median the two outer fingers are held extended with the thumb extended and adducted. The proximal and, in many cases, the distal transverse arches are flattened. Strapping to support both arches and a small cock-up splint must be applied to maintain the position of rest. When the nerve is divided below the branches to the flexors, support of the proximal arch is alone required.

The Special Forms of Treatment.

The object is to increase the circulation, to improve the nutrition, and to prevent the formation of adhesions. Marked vasomotor changes are present, the hand being cold and blue with a very poor circulation. A similar condition exists in the underlying muscles.

It is most beneficial to obtain a good circulation in the limb before the application of massage. Voluntary exercise by its general effect and heat by its local effect both accomplish this. In all nerve lesions of the upper limb a daily gymnastic course is advisable, unless there is some contra-indication such as active inflammation. Heat is best applied by the whirlpool bath.

Throughout treatment it is essential that the paralyzed muscles are held relaxed.

During massage passive movements of the fingers should be carried out with the greatest care to prevent stretching of the paralyzed muscles. Returning voluntary power is encouraged, and is carried out with the help of and not against gravity. Muscles which are recovering function are easily tired. As soon as the contraction shows signs of diminishing, the muscle should be immediately relaxed and massaged. Voluntary contraction of the other muscles should be encouraged provided the paralyzed muscles are not stretched.

With electrical treatment the nature of the current employed de-

pends upon the reaction of the muscle. If the whole muscle reacts to faradism, then this current alone is employed. If part only of the muscle reacts to faradism, the galvanic and faradic currents must be applied. If no reaction to faradism is present, the galvanic current only is applied. If there is no reaction to galvanism, electrical treatment is useless. A healthy muscle, made to contract repeatedly by a current, soon begins to show fatigue, a paralyzed muscle much sooner. Much harm may be done to a muscle, if it be stimulated after the onset of fatigue. As soon as the contraction to a given current begins to diminish, the current should not be increased; electrical treatment should be stopped and massage substituted.

It is advisable that massage, whirlpool bath, and electrical treatment should not be given separately for a definite period, but that they should be combined.

The curative workshops form a valuable adjunct to all other forms of treatment.

THE TREATMENT OF NERVE LESIONS WHEN ADHESIONS ARE PRESENT.

The Cause of the Formation of Adhesions.

Muscle paralysis and vasomotor changes predispose to but are not the actual cause of the formation of adhesions. This is shown by the complete absence of adhesions in many cases of complete nerve division. The real cause, apart from the direct involvement of tendons in scar tissue, appears to be the stretching of ligaments.

Ligaments possess afferent fibres which pass to the centre in the cord, and receive efferent fibres from the sympathetic system. When ligaments are stretched, chronic strain arises at the attachments; this gives rise to chronic reflex vasomotor changes, chronic inflammation, and the formation of adhesions.

When a nerve is completely divided, all the motor, sensory, and sympathetic fibres are destroyed. Stretching of the ligaments follows the loss of muscle tone, but, as they are insensitive, no reflex changes occur, and no adhesions develop. This explains the absence of adhesions in complete nerve lesions, when no splint has been worn.

If splints are applied to produce true relaxation, no strain is thrown on any muscle or ligament and no adhesions form.

If hyper-relaxation is produced, the opposite ligaments are stretched. These are sensitive; reflex changes are set up, and adhesions form. This explains the occurrence of adhesions in many complete nerve lesions following the application of splints to produce relaxation. Hyper-relaxation and not true relaxation has been produced.

When a nerve is completely divided, the sensory fibres alone may be involved, and no loss of muscle tone occurs. No adhesions form in such cases, as no ligament is stretched. When the motor fibres are involved, there is loss of muscle tone and the ligaments are stretched. If these are still sensitive, reflex changes are set up and adhesions form. This explains the occurrence of adhesions in many cases of untreated, incomplete nerve lesions, a fact pointed out by the French neurologists.

In the painful neuritic forms these vasomotor changes arise as the result of direct stimulation of the nerve. Hence the formation of adhesions in such cases, even if true relaxation is produced.

Principles Involved in the Treatment.

In all cases, except the painful neuritic forms, the formation of adhesions could be prevented by properly relaxing the paralyzed muscles and ligaments.

When present, the first consideration must be devoted to assist their absorption and to make the hand supple. At the same time treatment of the paralyzed muscles must not be neglected.

Three methods are available:

1. The encouragement of voluntary movement with the application of very slight force.
2. The application of moderate force.
3. The application of great force, the adhesions being broken down under gas.

As a rule, the nutrition of the involved structures is much impaired and marked vasomotor changes are present. Consequently the application of force is often followed by much swelling, oedema, and tenderness of the fingers. Similar changes must have occurred in the joints, and it is difficult to believe that much good could follow so marked a reaction. It is therefore advised that all cases should be first treated by a prolonged course of the first method.

The Treatment When Limitation of Flexion Alone is Present.

Limitation of flexion in musculo-spiral lesions is due to adhesions at the metacarpo-phalangeal joints, in ulnar and median lesions to adhesions around the joints and tendons. In the majority of cases the distal transverse arch is flattened.

In musculo-spiral lesions, full flexion of the fingers should be obtained by contraction of the flexor muscles; in ulnar lesions, full flexion, except perhaps in the little finger, by contraction of the median flexors; in median lesions, the ulnar muscles exert but little influence on the

thumb and two outer fingers, and in such cases more force is necessary.

The power of flexion of the fingers and thumb in the normal hand is greatest with the wrist dorsiflexed 45°.

The power of flexion of the fingers depends upon the maintenance of the distal arch, of the thumb upon the proximal arch. Flattening of the distal arch in the normal hand markedly impairs the power of flexion of the fingers. If strapping be applied to reconstruct this arch when adhesions are present, the patient states that he has much more power over the fingers, and that there is a feeling of tension over the dorsum of the joints, indicating that the flexors are now exerting much more power.

In treatment of these cases, the wrist must be dorsiflexed 45°, and the arches must be reconstructed.

a. Treatment by the Application of Slight Force. During the day the short cock-up splint is worn and the arches are supported by strapping.

In the massage department, after the application of the whirlpool bath, voluntary movement is encouraged with the wrist dorsi-flexed and the arches supported. Each joint is treated separately. In the case of the metacarpo-phalangeal joint the neck of the metacarpal should be supported while the flexor is contracting, as this allows much more power to be exerted at this joint. Were it not done, much of the force would be transmitted to the carpo-metacarpal joint. In the case of the phalangeal joints, the neck of the proximal bone is supported. As soon as the muscles show signs of fatigue they are massaged and electrical treatment substituted. Each joint is again treated separately and supported as in the case of voluntary movement. The treatment is then repeated, and the masseuse may on one occasion only apply the slightest passive force.

Success depends upon dorsi-flexing the wrist, reconstructing the arches, treating each joint separately, and making full use of voluntary power.

b. Treatment by the Application of Moderate Force. By moderate force is meant a gradually increasing pressure, so that the adhesions are stretched; it should be carried out once only in each direction. Apart from the fact that the firmer the adhesions the greater the force required, no rule can be laid down as to the amount of force to be applied. It should never be carried out if any signs of active inflammation are present, nor until the first method has been given a fair trial.

After the application of massage and the whirlpool bath the bones above and below the joint to be manipulated are held between the

thumb and finger of each hand, and as much pressure as the patient can bear is applied. This may be carried out every other day, but not if any signs of reaction are present. Treatment by the first method is employed in the intervals.

The method of dorsi-flexing the wrist and flexing all the fingers together is not recommended. There is little control over the individual joints, and, since the adhesions in all the fingers may not be of the same strength, each may require a different degree of pressure.

With adhesions present in all four fingers, the pressure applied to each should vary in force, duration, and frequency; any marked improvement occurring in one would give a clue to future treatment.

Should marked reaction follow this method, or no improvement occur, then some apparatus to exert gradual tension on the ligaments should be employed.

c. Treatment by the Application of Great Force. This is not recommended, a better functional result following the first two methods.

The Treatment When Limitation of Extension Alone is Present.

These cases usually result from contraction of the tendons or from peri-articular adhesions.

The object of treatment is to elongate the contracted structures so that the hand can be placed on a full cock-up splint with the wrist dorsi-flexed and the fingers extended.

With the fingers and thumb in a given position, the distance between the points of origin and insertion of the flexor tendons is greatest with the elbow extended and the forearm supinated, and least with the elbow flexed and the forearm pronated. In slight contraction of the flexor tendons, with very slight force the fingers can often be fully extended with the elbow flexed and the forearm pronated; with the elbow extended and the forearm fully supinated this will be impossible.

The method of gradual extension, recommended by General Sir Robert Jones for ischaemic contractures, is carried out and is not stopped until the hand can be placed on a full cock-up splint with the elbow extended and the forearm supinated. It is essential that during treatment the arches of the hand should not be flattened. If the condition is due to contracture of the flexor tendon alone, great care must be taken that during treatment full extension of the phalangeal joints does not occur; if due to contractures of the ligaments then it may be necessary to extend to the full articular limits. Limitation of flexion occurring during treatment is due to the arches being flattened, or full or even hyperextension at the finger joints being produced.

The splint must be removed each day to allow the application of massage, etc., to the involved structures. The splint should not be left off until all tendency to the recurrence of the contraction has been absent for six weeks, and even then should be worn at night for a further six months.

Treatment by forcible wrenching, with or without tenotomy, is not recommended, the functional result being invariably bad.

TREATMENT OF ADHESIONS WHEN LIMITATION OF FLEXION AND EXTENSION ARE BOTH PRESENT.

This consists of a combination of the previous methods, treatment of one condition to the neglect of the other being avoided.

STIFF FINGERS: WITH SPECIAL REFERENCE TO METHODS OF TREATMENT BY METAL AND PLASTER SPLINTS.*

BY P. JENNER VERRALL, M.B., B.C., F.R.C.S., LONDON.

ALTHOUGH the methods of treatment advocated in this article are applicable to the injuries occurring in time of peace, the immense frequency with which stiff fingers are caused by gun shot wounds, has provided a mass of clinical material on which my experience is based. I do not propose to consider the treatment of recent wounds of the forearm and hand or methods by which stiff fingers may be prevented, but shall confine my attention to cases in which all wounds are healed, such as arrive for treatment at an Orthopaedic Centre.

Apart from direct wounds and septic infection of the hand, stiffness of the fingers may, of course, result from wounds of the forearm involving tendons, wounds of the nerves, prolonged immobilization in splints, or disuse following functional paralysis or other causes. Putting aside the treatment of the primary cause in these cases, I propose to treat the incomplete function of the fingers as a purely mechanical problem.

* A paper read before the British Orthopaedic Association, July 26, 1918.

On these lines the causes may be placed in two classes, (*a*) Loss of extension, (*b*) Loss of flexion; though naturally there may be limitation of both functions. Treatment, however, should, on the lines I shall indicate, be mainly directed to either one or the other at any one time.

(*a*) Loss of the extensor function is commonly due to:

1. Contracture of muscle, traumatic, ischaemic or postural.
2. Adhesion of tendons to skin or other structures.
3. Peri—or intra—articular adhesions.
4. Nerve lesions of ulnar or median nerves.

The finger deformities associated with lesions of the median and ulnar nerves are well known, consisting typically of hyper-extension at the metacarpo-phalangeal joint and flexion at the distal joints. These deformities are very common in ulnar lesions, but occur in precisely similar fashion, but to a less extent, in median lesions, in the corresponding fingers. It may not, however, be quite so well recognized that these deformities are more marked in lesions of the respective nerves in the forearm below the nerve supply to the forearm muscles, than in lesions higher up.

I take the opportunity of tentatively suggesting that this may be due to the action of the respective part of the flexor profundus digitorum uncorrected by the intrinsic muscles of the hand, especially the lumbricales.

5. Loss of the flexor function similarly may be due to: (1) Involvement of extensor tendons in scar or callus, especially in wounds of the metacarpal region. (2) Adhesion of flexor tendons to skin or deep structures by scar. (3) Peri—or intra—articular adhesions. (4) Traumatic or postural contracture of muscles.

In brief, the fingers may have lost their free movement from fixation either of their joints or of the tendons which control them.

Tendons which are tightly bound down by scar tissue should be freed by operation and removal of the scar tissue; those which are adherent to skin only may be successfully treated by massage, or by excision of the scar if this fails or is tedious.

If tendons are short, a very determined effort should, of course, be made to stretch them before the advisability of lengthening them be considered, as in this event the muscle function is impaired by the resulting contracture of the muscle belly.

A few more words may be said on the subject of tendon-grafts in the hand. Grafts are not commonly successful on the flexor aspect of the hand, but it is quite otherwise with the dorsum. Cases are often

seen of extensive scars of the dorsum of the hand with destruction of extensor tendons, and perhaps metacarpal fractures. No mechanical treatment is of any avail until these tendons are potentially mobile.

A method from which success is frequently obtained is: Firstly to excise the scar, bringing skin together and ignoring the tendons. When the wound is healed, gentle massage prevents adhesion of the cicatrix to the deeper structures. At a second operation a piece of ilio-tibial band is removed and cut into strips about 5 m.m. wide in a longitudinal direction, the longitudinal fibres of this fascia making it especially suitable. These strips are applied as grafts to fill up the gaps in the tendons, being fixed by thread sutures. It is better to make the graft overlap the sound tendon well at either end and to suture it firmly, as thus movement may be begun at an earlier period and adhesion of the graft prevented. After 6 weeks more forcible measures may be taken to increase movement.

It will be convenient to take a few types of "stiff fingers" to illustrate the methods advocated.

A. Fingers flexed when wrist is dorsiflexed; extension possible with wrist flexed.

This, the type of ischaemic contraction, due to shortening of the flexor tendons, cannot be better treated than by the method of Major-General Sir R. Jones, which consists in straightening the joints seriatim on splints applied to the flexor aspect, beginning with the distal, leaving each joint in the deformed position until all the joints distal to it are corrected, and retaining that correction by continuing splinting. Care must, however, be used lest one overlook constriction or involvement of one or more tendons in scar, as in this case, unless the tendon be freed from scar by operation, an apparent cure by the above method will be followed by a speedy relapse.

B. Wrist movement free: One or more fingers flexed at all three joints—contraction unaffected by position of wrist.

This condition is most typically seen as an after result of the so-called "fist plaster," in which, under an anesthetic, the fingers are forcibly flexed as far as possible, and the whole hand (previously covered with felt) enclosed in plaster. The fist plaster is a valuable method of treatment for obstinate cases, but it often has the disadvantage of converting a fixed extended hand into a fixed flexed one, though the latter is naturally the better, if one has only a choice of evils.

In treating a case of this type, one should aim at obtaining extension without losing flexion. If the flexion is complete, that is to say, the

patient is able to touch the palm with the tips of the fingers, so much the better, but, in any case, the degree of flexion should not be lost; any loss being an indication that treatment is too rapid.

For this purpose I have devised a metal splint, which is applied to the dorsal surface of the hand and forearm by plaster of Paris. The splint consists of a bar of iron ½ inch wide and ⅛ inch thick, which terminates distally in a triangular loop, the whole splint being about 16 inches long, and the terminal transverse bar of the triangle 4 inches in length.

To the proximal end of the splint is fixed a strip of thin metal, 1 inch wide (perforated to ensure adhesion to the plaster) which encircles half the circumference of the forearm.

The axial bar is curved at the wrist to follow the curve of the partially dorsiflexed wrist and a small plate is fixed to it to rest on the back of the band and prevent rotation of the splint.

FIG. 1.—Finger extension splint. Treatment nearly complete.

The terminal triangle is curved slightly toward the palmar surface, so that the transverse bar is situated 2 inches beyond the point that the fingers would reach if fully extended. If this bar be too much towards the dorsum, there is danger of producing hyper-extension at the metacarpo-phalangeal joints.

The hand and forearm are encased in felt, the thumb protruding through a hole in the felt, the splint applied, and plaster applied enclosing limb and splint down to the level of the neck of the metacarpals.

The plaster must not reach below this point on the palm, as otherwise flexion of the fingers would be obstructed. After the application of the splint 24 hours are allowed for the plaster to set hard.

Adhesive plaster is then applied so as to enclose the two distal phalanges of each finger and leave a loop at the end of the finger. This is best done by cutting the plaster as in diagram.

Tapes are passed through the loops, tied to the transverse bar of the triangle, and progressively tightened as extension improves. Every day the tapes are untied, the fingers flexed to their original position several times, actively and passively, and the tapes retied. This latter is an essential part of the treatment, and is best carried out in a massage department. The force exerted by this method is surprising, very little discomfort is caused to the patient, and the only point that needs attention is the preservation of the flexion. Should extension be obtained at the price of a loss of flexion, the tapes are tied less tightly, or even relaxed for a day or two till flexion returns.

C. Free movement at the metacarpo-phalangeal joints: two distal joints flexed.

This is typically seen in ulnar (or, more rarely, median) paralysis. For the treatment of this condition small palmer gutter splints to the fingers are usually sufficient, but occasionally extreme contractures are seen, which can well be treated by the dorsal extension splint described above.

D. Metacarpo-phalangeal joints stiff in hyperextension; distal joints straight or slightly flexed.

A very common type, which may result from most of the causes mentioned above. I have already described the preliminary treatment of this type, comprising excision of scars, freeing of tendons, tendon grafting, etc.

The important underlying principle in the treatment of this type consists in getting the metacarpo-phalangeal joints to pass the dead-point or straight line position. Once there is a slight degree of flexion

at these joints further progress is much more rapid. In order to pass this point one may use a fist plaster, and this is sound treatment.

Personally I prefer a more gradual method, which can be effected by the use of the splint, which I shall now describe. Probably every orthopaedic surgeon is acquainted with the short cock-up splint of Sir Robert Jones. It consists of a metal gutter splint reaching along the flexor aspect of the lower half of the forearm, curving upwards on the palm, being flattened out and holding the wrist in dorsiflexion.

To one of these splints (cut short so as not to reach beyond the metacarpal necks and narrow in the palm, so as to allow some degree of movement between the metacarpals) is fixed a quadrilateral loop of stiff wire. This loop springs from the palmar surface of the splint at its angle and leaves the forearm portion at approximately the same angle as the palmar part of the splint. The loop reaches a point slightly beyond the level of the metacarpo-phalangeal joints and is furnished with an additional cross-bar near its point of attachment to the main splint. The splint is applied with plaster of Paris over

FIG. 2.—Finger flexion splint applied.

felt, care is taken to free the heads of the metacarpals, and extension tapes are fixed as for the splint described above. Traction is then made, first to the extremity of the loop, whereby the metacarpo-phalangeal joints are flexed, and later to the cross-bar, whereby these joints are further flexed, and the inter-phalangeal joints also treated. As before, daily untying of the tapes and massage ensures preservation of the range of movement.

When the dead point is well passed, a good method of treatment, evolved from the suggestion of Dr. Mennell (in charge of the Massage Department at Shepherd's Bush), is to utilize a plaster splint moulded to the dorsum of the hand, and distal half of the forearm, reaching only to the proximal interphalangeal joints, holding the fingers in the extreme degree of flexion obtained and leaving the two distal phalanges free. By placing successive layers of felt between the splint and the first phalanges flexion is increased, massage being continued meanwhile. A series of these splints will complete the passive corrective treatment.

Having by these means obtained a fair degree of passive movement and some active movement, the patient should then receive treatment in a gymnasium. Lieutenant Eggleton (in charge of the gymnasium at Shepherd's Bush) has a system of graduated grips and finger training apparatus which gives excellent results.

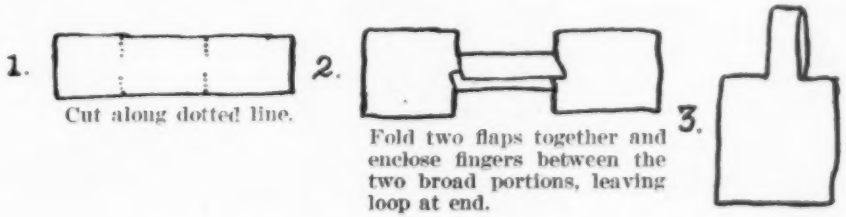
Finally, employment of the hand in a workshop, preferably at the patient's own trade, provides the best training for functional utility of the hand. Such curative workshops are in existence at Shepherd's Bush and most other orthopaedic centres.

The principal advantages claimed for the above methods of treatment by metal splints are:

1. The power, that it is possible to exert, is very great, but, at the same time, can be graduated to a nicety.

2. The correction is gradual and continuous and consequently causes little or no pain and discomfort to the patient.

3. Movement of the fingers is continued without removal of the splint and the range of movement is never lost. This is the most



Cut along dotted line.

Fold two flaps together and enclose fingers between the two broad portions, leaving loop at end.

important point of all, the daily massage and movement being an absolutely essential part of the treatment.

4. The splints, being applied with plaster, do not tend to slip off, as do other splints, when any degree of traction is applied to the fingers.

5. Each finger is treated separately, and therefore the fingers may be at different stages of treatment at one time on the same splint.

Once I did consider using elastic traction. I don't know whether you read the article on supination plaster, but it was after that I started using, by means of a rubber tube, continuous elastic traction, Sir Robert Jones pointed out to me and quite rightly, that if you are using elastic traction you are inviting the muscles all the time to fight against it, and if you work it by a system of jerks, pulling a little each day, you are not asking the muscles to be perpetually fighting. At first I used elastic traction for both these methods, but I have now given it up.

DISCUSSION

THE PRESIDENT: These papers are full of important and instructive details, and the discussion on both of them is now open.

CAPTAIN MCCRAE AITKEN: Everyone is wanting to get away, but I do not think it would be fair to the authors, nor to these important papers, for no word to be said about them.

With regard to Mr. Verrall's paper, all I have to say is, that the splints which he has introduced have become part of the regular routine treatment, I think, by every surgeon at the Military Orthopædic Hospital, Shepherd's Bush. He referred to the plasters for forcible flexion of the fingers, a method of procedure which, at one time, I used very freely. I found exactly the difficulty that he has found; that a finger forcibly flexed and kept flexed, remained flexed. I now hold to the method of treatment which he has introduced.

The paper by Mr. Hammond is an entirely different matter. I think there is reason to regret that Mr. Hammond has loaded an important point such as that which he has brought forward by putting in such a wealth of detail. That makes a paper read before such a society as this—unless one knows about it beforehand—difficult to follow. For my part, I intend to carefully read the paper when it is published, so as to dig out from it the very important essential facts it contains. I think it is the first reasoned proper description of the hand and the position of its various joints, which I have encountered, and I believe that in the time to come it will stand as one of the classics, which nobody reads, but the essence will pass into our text-books, and become part of the ordinary descriptive work for the correction of hand deformities.

CAPTAIN PLATT: Mr. Hammond's paper, as Captain Aitken has already said, is full of important details, and a very important conclusion is drawn, which perhaps has not been sufficiently realized by the meeting,—namely, the importance of this attitude which he named the attitude of physiological rest in the hand, and of maintaining this attitude practically as a routine standard position in the treatment of nerve injuries, not merely of musculo-spiral injuries, but median and ulnar nerve injuries. And I think some of us, for some time, have been unconsciously arriving at the use of that position without exactly knowing why. Mr. Hammond's description of the arches of the hand is one of exceeding importance; it is one which should be read by everybody. It

is rather a pity that Mr. Hammond had not here some of his models and splints in order to illustrate and drive home more effectively his points. Personally, I feel exceedingly interested in his paper, and I have enjoyed it very much.

MR. BENNETT: I, also, thank Mr. Hammond for his excellent paper, because it insists on the importance of posture, not only of the hand, and I never heard a paper which impressed me more with regard to the postural treatment of diseased conditions, and of abnormalities resulting from injury.

MR. HAMMOND: I wish to thank all who have spoken so kindly.

MR. VERRALL: I should like to say the same for myself.

AN OPERATION FOR THE PERMANENT CORRECTION OF WEAK FEET IN CHILDREN.

BY CHARLES OGILVY, B.A., M.D., F.A.C.S., NEW YORK CITY.

THE particular type of weak feet for which this operation is specially recommended is that in which there has been present from the beginning an abnormal eversion of the foot with the associated change in the relationship of the foot to the leg. This change of relationship brings the body-weight bearing strain through the inner border of the foot. The body-weight is not directed as it should be through the ankle and over the dorsum of the foot to the second toe. In taking the history of such cases we usually find that they are hereditary.

MECHANICAL METHODS OF CORRECTION.

This correction is aimed at the maintenance of the proper relationship of the foot to the leg. This is accomplished by inverting the foot and maintaining this inversion. Inversion is obtained by means of raising the inner border of the heel of the shoe or raising the inner border of both heel and sole of the shoe.

In addition to the alterations on the shoe many employ some form of insert inside the shoe, such as a metal plate, to obtain the same end. The term "arch support" should be entirely discarded. Our object is not to "support" the arch, but it is to so control the position of the foot as to hold it in its proper relationship to the leg.

What results do we obtain by the employment of such means in these cases to which we have referred?

The answer is that after this treatment has been carried out for several years we find (1) the foot iself has not suffered from foot strain; (2) that the long arch of the foot is perfectly normal with the exception of the astragalo navicular articulation; (3) that the patient when

FIG. 1.—B. G., age 4 years. Case of hereditary weak feet.

FIG. 2.—A. M., age 14 years. Weak feet.

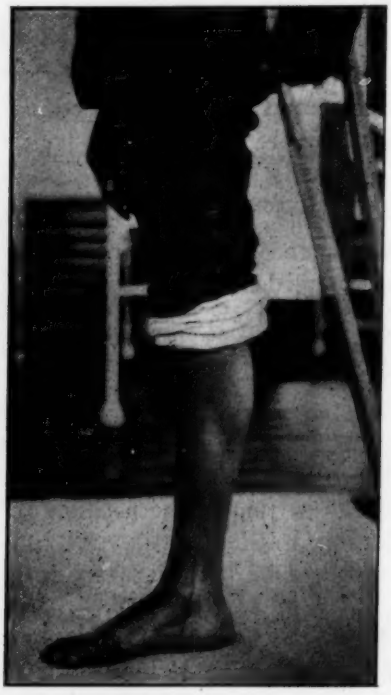


FIG. 3.—A. M. Same case Post-operative. Seen one year later without any sign of relapse.

FIG. *3a*.—Same case one year after operation.

FIG. 4.—G. Q., age 11 yrs. Before operation.

FIG. 5.—G. Q. Five years after operation.

walking maintains the correct relationship of the foot to the leg as long as the artificial means of correction are being worn, but (4) *when these corrected shoes are removed and the patient bears his body weight upon his feet it will be seen that the abnormal eversion originally present still persists.*

After studying these cases for a number of years and failing to obtain a permanent correction by all mechanical means available, I determined to operate upon these children. Relapses constantly occurred after the artificial means of correction had been removed, notwithstanding the fact that these were continued for upward of four to five years.

Upon examination it is found that at this age (from eight to fifteen) the point of greatest relaxity is at the astragalo navicular articulation. Here we have a more or less ball and socket joint upon which the forefoot pivots. With the toes turned outward the strain upon this joint is increased and gradually the relaxity of the joint ligaments is accentuated. Subsequently the head of the astragalus rotates downward and inward. The greatest strain is at this joint. The other parts of the foot, including the astragalo-tibial joint, are at this age practically normal.

It seemed to the writer that by arthrodesing the astragalo navicular articulation with the foot held in forced inversion, a firm fibrous union could be obtained. This being the case, it would follow that the astragalo calcanear articulation would become locked by reason of its

FIG. 6.—F. P., age 12 years. Before operation.

FIG. 7.—F. P. Six years after operation.

FIG. 8.—M. L. Six years after operation.

FIG. 9.—D. S. Before operation.

FIG. 10.—D. S. Same case five years after operation.

mechanical construction, and this in turn would immobilize the os calcis. The head of the astragalus, also, would by this fixation to the navicular bone be prevented from slipping downward and inward.

This altered position would prevent the transferring of the weight strain to the ligamentous structures on the inner border of the foot, namely, the interosseous and the deltoid ligaments. By this exaggerated inversion the foot relationship would be corrected under weight-bearing to its normal position directly beneath the leg.

The question at issue was whether or not an arthrodesis of the astragalo navicular articulation that would permanently hold the foot in this corrected position could be obtained at this age. Arthrodesing of this joint is by no means a new procedure, but its application by the following method for this purpose, at this age, has not been generally practised. The first of these operations was performed on October 10, 1912, over six years ago, so that sufficient time has now elapsed to judge of the value of this procedure. The writer has performed this operation over seventy times.

FAILURES.

Failure to obtain a satisfactory result has been experienced in six cases. These were among the earlier operations performed. In two of these cases a secondary operation disclosed a reproduction of a perfectly normal joint, from a macroscopical examination of which it would have been impossible to have known that there had been any previous operation.

One of the reasons why we were unsuccessful in obtaining results in these cases was due to the fact that these were in younger children, ages five to seven years. Another reason of failure was that weight-bearing strain was permitted too soon after operation.

TECHNIC OF OPERATION.

Apply an Esmarch bandage above the knee.

Having surgically prepared the foot, make a longitudinal incision one and one-half inches in length on the inner border of the foot, directly over the astragalo navicular articulation. Carry this incision boldly down to and opening into the joint.

Expose the head of the astragalus by retracting the joint ligaments. Force the head of the astragalus downward and inward and have it held in this position by an assistant.

With a small chisel remove the articular surface of the head of the bone. Care must be taken to maintain the contour of the head of the astragalus. The removal of this cartilaginous surface should be very thoroughly performed. No part of it should remain.

The articulating surface of the navicularis is then treated in the same way.

With a small bone curette both of these surfaces are then thoroughly but smoothly curetted. It is then seen that when the forefoot is inverted the surfaces are evenly in apposition.

The deeper structures are now closed with four or five interrupted sutures of chromicized catgut No. 1. The skin is united with continuous plain catgut suture No. 1.

The foot is put up in a plaster of Paris cast in marked inversion, care being taken by exaggerating the position of varus to bring the head of the astragalus in apposition to that portion of the articulating surface of the navicularis approximating the cuboid. By this means when, later, the foot is freed from its plaster dressing, the forefoot carries with it to a certain extent the astragalus in an outward direction in contradistinction to the inward rotation which it takes in a weak foot.

The operation should not be performed before eight years of age.

POST OPERATIVE TREATMENT.

The plaster of Paris dressing should not be removed for five weeks in older children, and six weeks in younger.

After the removal of the plaster dressing the foot will be found to be in an over-corrected inversion. This will gradually decrease until at the end of three months from the time of the operation, the patient will be walking with ease and comfort.

It is well to have the inner border of the heels built up a full three-sixteenths of an inch and continue to be so worn for a year after the operation.

THE TREATMENT OF JOINTS STIFFENED BY WAR INJURIES.

BY MITCHELL LANGWORTHY, CAPTAIN, M.C., U.S.A.,

First Orthopædic Unit, A. E. F., France.

IT is the purpose of this article to discuss briefly the principles and practice of the treatment of limited function of joints due to changes in the soft tissues only, which are the result of war injuries.

The changes in these tissues, namely the capsule, ligaments, muscles and tendons, are those of the scar formation and loss of substance, or both. In those wounds which have healed by the slow, open drainage process, scar formation predominates. In those where an early suture has been possible, loss of substance, either the result of the injury itself or the operation necessary to make early suture possible, is the important factor.

It is essential before considering treatment to separate as definitely as possible this group of cases from those in which changes in the bone itself and its articular cartilage are limiting function. Also it is necessary to determine whether bony changes account for all or only a part of the limitation. The history and clinical course of the injury will furnish very important information. Combined palpation and manipulation will, in experienced hands, be the determining diagnostic measure. There is a characteristic "feel" to a joint whose movement is limited by soft tissue changes, even when practically no movement can be obtained which differentiates it from the obstruction to function caused by bone changes. If this can not be made out definitely, it is wise to repeat the examination with the patient anaesthetized, when the difference is more easily detected with the elements of pain and muscle contraction removed. Diagnosis is completed by radiographs of the joint, and treatment should almost never be started until these are seen to show no bony or articular obstruction to movement. These cases constitute a large portion of those which will come to reconstruction hospitals for several years, and proper treatment will make them one of the most satisfying groups of results.

The principle of treatment, which in the writer's opinion is most universally applicable, is that of gradual movement of the joint by a series of small movements which increase daily, starting always from the original position, and followed by immobilization for about 24 hours in the new position. To illustrate exactly what is meant, let us start with a knee stiff in full extension of 180 degrees. This should be bent to perhaps 178 degrees and immobilized in that position until the next day. Then the immobilization is released and the knee is

fully extended back to 180 degrees several times, both actively and passively, and then bent again, perhaps to 175 degrees, and immobilized in that position until the next day. Each day the angle is increased, always, however, being extended to 180 degrees several times before immobilization in the new degree of flexion.

Two other methods have been employed with success in certain cases; one, manipulation under anesthesia with or without immobilization following, and the other the continuous application of a stretching force with an elastic or spring tension. Without entering into a theoretical discussion of the relative merits of these methods, it seems wise to mention their outstanding faults as found in practice. Cases of stiff elbows and knees which have been manipulated under anesthesia have frequently come into the writer's wards with a violent lighting up of the old infectious process which has been lying dormant in the tissues. This is an ever present danger. Also, after manipulations of this kind, if the joints are immobilized for any length of time, in a large number of cases they are found to be just about as stiff in the new position as they were in the old; due probably to new adhesions formed as a result of inflammatory processes set up by the tearing of old scar tissue and even normal tissue where there has been shortening due to loss of substance. If these joints are not immobilized, the attempt to keep up movement has in many cases been a failure, for the patient himself will not help in this because of the pain associated with movement. In reality he keeps the joint as comfortable as possible by carefully preventing motion, which immobilization for probably more than 23 hours a day very much overbalances what good might come from a few minutes of exercise and massage given the joint by a busy attendant.

Good results are possible and no harm is done by the method of continuous stretching with elastic or spring tension. The writer believes, however, from a comparison of cases that a longer time is required to move the joint through the desired arc, and that a longer period of subsequent exercise and massage is necessary than with the method he is advocating. The reasons for this which suggest themselves are, first, that due to the constant tugging of the stretching device and the continuous discomfort, the muscles controlling the joint are constantly resisting movement, and, second, that sufficient time is not allowed for the actual lengthening of the tissues by new cell growth.

The method which will now be described avoids the faults of the other methods and has certain advantages. It can be employed so gently and can be so easily graduated that the great danger of light-

ing-up latent infection is minimized. For this reason also it can be employed much earlier, which is a distinct advantage. The ability to return or resume the original position will not be lost. In other words, a knee stiff in complete extension which is being flexed will not lose the power to completely extend while regaining flexion. The most valuable feature of this method is the relaxation of all tissues which takes place during the daily period of solid immobilization. This occurs to such an extent that the force necessary to increase the range of movement each day is minimized. The process really becomes one of repeatedly taking up slack. Also it would seem probable that the short tissues were allowed time to grow longer, to lengthen constructively, rather than to be destructively stretched. There is, too, a psychical value, which should not be underestimated. Observation by the patient of the daily improvement and the fact that the patient does with his own muscles move the limb from the starting point through a gradually increasing arc, undoubtedly shortens the duration of treatment. Thus also is accomplished a gradual reëducation of muscles which have not been functioning. This is not nearly so easily accomplished after a forcible manipulation under anesthesia, in which case the greatest desire of the patient is to prevent the pain which movement causes.

The following paragraphs consist of descriptions of several simple forms of apparatus which the writer has devised for the application of the method which he is advocating. The success which has followed the use of these simple devices has led the writer to believe that the principle is sound.

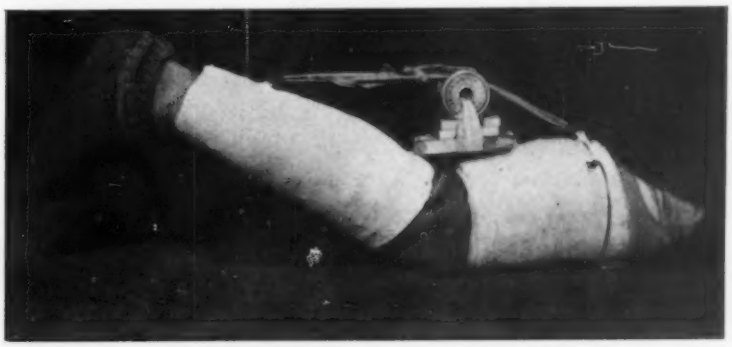


FIG. 1.—Apparatus for immobilization used in the treatment to regain flexion of a knee joint stiff in extension.

FIG. 2.—The same as Fig. 1, showing how the small board should be arranged to prevent downward slipping of the thigh cast and to prevent its lower edge from pressing into the popliteal space.

TREATMENT OF A KNEE STIFF IN EXTENSION.

See Figures 1 and 2.

Over three months were spent with almost a daily trial of different apparatus and modifications of them, before the following simple, mechanically correct, light and comfortable flexion method was worked out. The knee is allowed to be its own hinge. No simple hinge at the knee will do because it will not correspond to the hinge of the joint, and strain and discomfort will be coincident with its use. First, a snug plaster cast is applied to the leg from just above the malleoli up to the point on the leg which touches the thigh when the knee is flexed to 90 degrees. Another cast is applied to the thigh reaching up as high as possible and down to the point on the thigh which touches the calf when the knee is fully flexed. A piece of telephone wire is bent and incorporated in the plaster and caused to project at the back of the upper end of the leg cast so that the end of a board three inches wide laid against the back of the knee and pushed downward from above will be maintained about one inch below the edge of the upper end of the leg cast. A similar piece of wire is incorporated in the back of the thigh cast and caused to project half way between the upper and lower edges, so that the end of the board laid against this wire loop cannot progress upwards. At the extreme upper edge of the thigh cast and at the lower edge of the leg cast posteriorly a wire is incorporated in the plaster and allowed to project as a small loop. A piece of small rope and the light board mentioned above complete the materials necessary for beginning treatment.

The patient is placed face downward on a table, in the top of which it is well to have cut two slots so that a wide strap can be placed over the thigh cast, through the slots, and anchored below for the purpose of holding the thigh firmly on the table. The ankle is then grasped around the malleoli and raised and with the knee thus flexed, no matter how slightly, the board is marked so that it may be cut to fit between the two wire projections in the casts above and below the knee. At the time this measurement is made the thigh cast must be shoved as high as possible, since it has a tendency to slip down, due to the conical shape of the thigh. When the board is ready, the strip of webbing or rope is passed through the small loop at the lower end of the leg cast and the loop at the upper end of the thigh cast. The knee is then flexed as far as comfortable by lifting the foot. The board is slipped between its wire loops and the rope is pulled tight and tied by an assistant. The little board placed as directed prevents the thigh cast from slipping down and also, because its upper end is anchored so high up on the thigh cast, prevents the lower edge of the cast from pushing forward into the popliteal space. On the correct arrangement of this small piece of board and the wire loops which hold it hangs the entire efficiency and comfort of the apparatus. The next day the patient is again placed on the table, the rope is untied and the board removed. The knee is passively extended and as much active flexion and extension as is possible is performed by the patient several times. This done, the knee is flexed as much as possible in the same way as at the beginning of treatment, and the board is marked again to fit in between its wire loops which, with the increase of flexion, will be approximated. When the board has been shortened, flexion is repeated, the board slipped in and the rope tightened and tied as before. It is sometimes difficult to tie the rope so that some of the flexion is not lost. This may be remedied and the rope made as tight as desired by laying enough small blocks of wood on the board to reach and tighten the rope, as in Fig. 1. It will be seen that this is not in itself a device for flexing the knee. It is rather a means for immobilizing the knee in the position in which it is placed by the operator. It does the same work which a series of complete circular casts, including thigh, knee, and leg, would do, the old one being removed and a new one being applied each day.

Flexion of an elbow stiff in extension is accomplished in exactly the same way as that just described for the knee, the arm being prepared as was the thigh, and the forearm as was the leg.

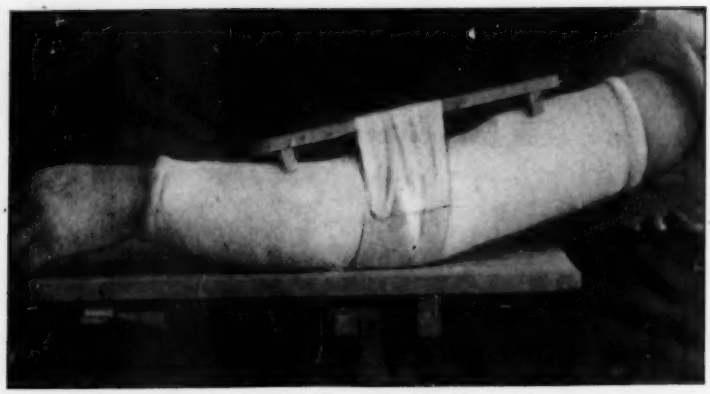


FIG. 3.—Apparatus for immobilization used in the treatment to regain extension of an elbow stiff in flexion.

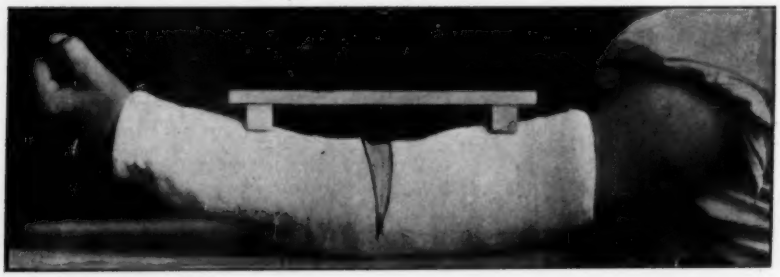


FIG. 4.—The same as Fig. 3, but before the adhesive strap is applied, showing the gap in the cast and the position of the board.

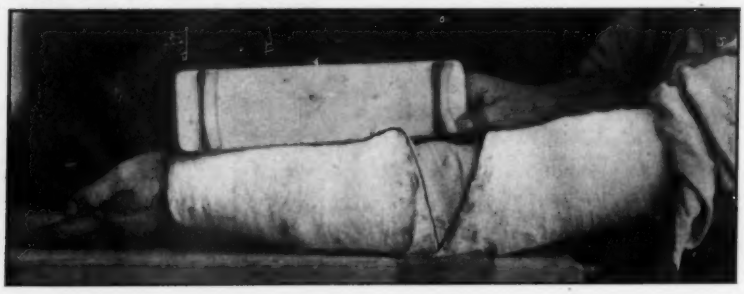


FIG. 5.—The same as Fig. 3, but with the board and adhesive strap removed showing the gap in the cast after complete extension has been secured. The patient is able to completely extend the elbow and also to flex it back to the starting point.

TREATMENT OF AN ELBOW STIFF IN FLEXION.

See Figures 3, 4 and 5.

A continuous circular plaster cast is applied from as high up on the arm as possible to just above the wrist with the elbow extended as much as possible. The forearm had best be in the position of supination. With a sharp knife, just before the plaster has set completely, a transverse cut is made through the entire thickness of the cast, extending across the front of the line of the elbow joint from slightly behind the internal and external condyles of the humerus. It is well to let the plaster then harden until the next day, when extension is begun by holding the arm flat on a table and pressing down on the wrist. The linear cut becomes a gap. Immobilization is accomplished by placing a board about three inches wide and about twelve inches long on the cast lengthwise over the gap, and then encircling the cast and the board with a wide strip of adhesive tape which runs around the point of the cast over the elbow and over the middle of the board. The following day the adhesive strap and the board are removed. The elbow is passively and actively flexed and extended. It is then immobilized in an increased degree of extension by reapplying the board with the adhesive strap.

Extension of a knee joint stiff in flexion is brought about in exactly the same way as that just described for extending a flexed elbow.

FIG. 6.—Apparatus used in the treatment to regain dorsal flexion of a foot stiff in plantar flexion. With the foot dorsally flexed as shown, more extension of the knee than is shown was not possible. The cast is ready for the cut across the back of the knee.

FIG. 7.—The same as Fig. 6, showing the gap where the cut was made after complete extension of the knee. During the extension the foot has remained dorsally flexed.

TREATMENT OF AN ANKLE JOINT STIFF IN PLANTAR FLEXION.

See Figures 6 and 7.

Most of the cases in which the ankle is stiff with the foot in the equinus position are due to shortening of the Achilles tendon. In a large percentage of these cases, the foot can be considerably dorsally flexed if the knee is fully flexed, which of course approximates the origin of the gastrochemius above the condyles of the femur to the insertion of the muscle into the os calcis. To stretch the gastrocnemius and Achilles tendon in these cases proceed as follows: Flex the knee completely. Dorsally flex the foot as far as possible. In this position apply a continuous plaster cast over foot, ankle, and leg. Do not include the knee. Let this cast harden. Now extend the knee as far as possible and continue the cast on the leg over the knee and high up on the thigh. Complete extension of the knee will not be possible because the gastrocnemius is pulled taut by a few degrees of extension. Before this part of the cast is completely set, make a linear cut through the back of the cast at the line of the knee joint, running forward on each side to within about one inch of the patella The next day extend the knee. The linear cut becomes a gap. The knee is then immobilized with a board and an adhesive strap, the procedure being throughout the same as that for the extension of the elbow. Lengthening of the gastrocnemius and Achilles tendon is much easier by this method than it is by the direct employment of the foot as a lever.

FIG. 8.—Apparatus used in the treatment to secure flexion of fingers which are stiff in extension.

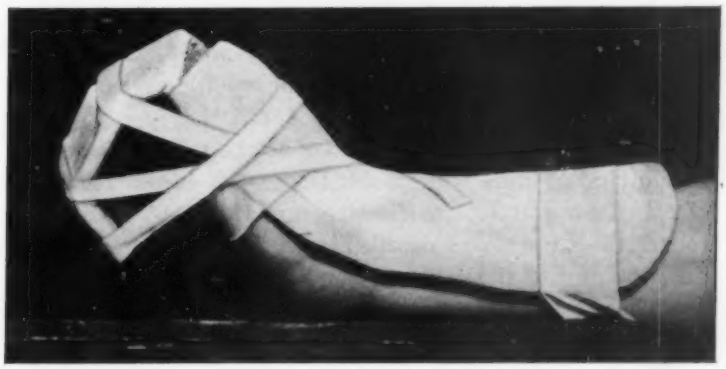


FIG. 9.—The same as Fig. 8, seen from the opposite side.

TREATMENT OF FINGERS STIFF IN EXTENSION.

See Figures 8 and 9.

Flexion is gradually secured in these cases by the aid of a splint made as follows: One good plaster bandage five inches wide and five yards long and two pieces of thin webbing strap one inch wide are the necessary materials. The plaster bandage is lapped back and forth lengthwise on itself on a smooth surface to make a slab five inches wide and long enough to reach from the middle of the forearm to one inch beyond the finger tips. While making this slab, when one-third of the bandage has been used, the webbing straps are laid lengthwise one inch apart, running from one end of the slab to the other. The remainder of the bandage is then laid back and forth over these. This wet plaster

slab is then applied to the back of the forearm, wrist, hand, and fingers, and should extend one inch beyond the finger tips. The patient's wrist is then dorsiflexed and the plaster slab molded to fit the forearm, wrist, and back of the hand, rounding down smoothly over the sides. The part of the slab over the metacarpo-phalangeal and interphalangeal joints should not be molded down around the outsides of the index and little fingers, but should be left flat from side to side. If any flexion of the fingers is possible, the slab should be bent to take up this, but from side to side the slab should not be bent or arched. If this part of the slab is much too wide for the fingers it can be marked and later trimmed so that it is just a little wider than the hand at the metacarpo-phalangeal joints. Marks should now be made, with the splint still on the hand, just distal to the metacarpo-phalangeal and interphalangeal joints of the middle finger, and extending from one side of the splint to the other. These should be straight lines. The splint is removed when set, and with a sharp knife cuts are made on the three lines across the joints down to the webbing straps which are to act as hinges. The splint is then dried out thoroughly, preferably by baking in an oven. The entire border of the splint is covered with an adhesive strip one inch wide molded over the edges. The splint is applied by fastening it to the forearm and hand with one adhesive strap around the upper end of the splint and forearm and another strap across the part of the splint over the back of the hand and around the palm. These two straps are not removed during the daily adjustment. Gradual flexion of the fingers can now be started and each joint should be flexed separately. First the metacarpo-phalangeal joints are flexed as much as possible by the pressure on the section of plaster over the first phlanges. The flexion is retained by a strip of adhesive one-half inch wide passed across the distal edge of this section of the splint and then around that part of the splint covering the back of the hand to which it is fastened. The proximal interphalangeal joints are now flexed by pressure on the section of the splint over the second phalanges. The flexion secured is held by an adhesive strap across this section of the splint and around the back of the hand as before. Flexion of the distal phalanx is obtained by the same method and retained with a third adhesive strip across the distal section of the splint and around the part of the splint covering the back of the hand. Each day these three adhesive strips should be released, preferably by cutting them at the edges of the splint. The fingers should be brought back to complete extension several times and then flexed again as far as possible, joint by joint, and then fixed there till the next day.

If a digression from the particular class of cases which has been discussed may be permitted, it should be mentioned that the method of treatment here advocated is very useful in conjunction with the psychotherapy employed in cases of purely functional flexion and extension deformities.

Twenty months of continuous war orthopaedic work, first in a base hospital where patients with injuries received as far back as 1914 were treated, and then in a base hospital in the advance zone where the cases were treated a few days after the reception of the injury, has afforded the writer an opportunity to use and compare all the different methods, and he is convinced that treatment based on the principle herein described produces the best results in the largest number of cases.

A SURVEY OF THE ORTHOPÆDIC SERVICES IN THE U. S. ARMY HOSPITALS, GENERAL, BASE, AND DEBARKATION.

BY ROBERT B. OSGOOD, LIEUT.-COLONEL, M.C.

Soon after the beginning of the war, General Gorgas created the Division of Orthopædic Surgery in the Surgeon-General's Office, with Major (now Colonel) E. G. Brackett as its director, and Major (now Lieutenant-Colonel) David Silver as assistant director. Major (now Colonel) J. E. Goldthwait had sailed in March, 1917, as director of a unit of twenty orthopædic surgeons, whose services had been requested by the British Medical Department for work in the Orthopædic Centers of Great Britain, under Colonel (now Major General) Sir Robert Jones, director of Military Orthopædic Surgery for Great Britain.

Colonel Goldthwait returned to America in August, 1917, and went back to England in October with 42 more orthopædic surgeons for similar service. As more groups arrived later, well-trained orthopædic surgeons were released to France to help with the oganization of the Division of Orthopædic Surgery with the American Expeditionary Forces in France, of which he became director. Between 60 and 70 orthopædic men were constantly maintained in British hospitals during the war, and at the time of the signing of the armistice they numbered 91.

During the winter of 1917-18, the so-called Professional Divisions overseas were reorganized under a single director, Colonel William L. Keller, Regular Army Medical Corps, with Major (now General) J. T. Finney as Chief Consultant in Surgery, Major (finally General) William Thayer as Chief Consultant in Medicine, and Colonel Siler as Director of Laboratories. Colonel Goldthwait's title then became Senior Consultant in Orthopædic Surgery to the American Expeditionary Forces. This title he retained until he returned to America in March, 1919.

Overseas, the responsibility for all the bone and joint work outside the Evacuation Hospitals was placed upon the Senior Consultant in Orthopædic Surgery, acting under the Chief Consultant in Surgery, by circular No. 29, which read as follows:

AMERICAN EXPEDITIONARY FORCES.

Circular No 29. France, 21 May, 1918.

The following instructions are issued for the guidance of all Medical Officers, superseding Circular No. 11, C. S. O., March 6, 1918:

1. Injuries to the bones and joints, as well as of the muscles and tendons adjacent to these structures, represent a large percentage of the casualties of both the Training and Combat Periods of an Army.

2. To restore useful function to these injured structures is one of the purposes of the Medical Organization of the Army. The problems involved in this have to do not only with the cleaning and healing of the wounds, but also with the restoration of motion in the joint and strength to the part. This latter part naturally follows the first, but it is essential that the first part be carried out with reference to that which is to follow. Unless this second part of the treatment, the restoration of strength and motion, is carried out, much of the first part is purposeless.

3. To insure the man not only the proper treatment of this type of injury, but the proper supervision until he is as fully restored as possible, necessitates some form of radical control that makes it impossible for a man to be overlooked in inevitable transfers, from service to service, or hospital to hospital.

4. Since so much of the ultimate result in these conditions depends upon orthopædic measures after the first treatment of the wounds has been carried out, the following will govern:—

The Senior Consultant, Orthopædic Surgery, will, under the Chief Consultant, Surgical Services, make such recommendations relative to treatment of "injuries and diseases of the bones and joints, other than those of the head, as well as to the injuries or diseases (other than nerve lesions) of the structures involved in joint functions," as will insure early restoration of functions, shorten convalescence, and hasten return to active military duty.

He will also supervise the sub-divisions of surgery, pertaining to

bones and joints, in a manner which will permit the complete surgical harmony necessary for coöperation in treatment of these cases by either general or orthopædic surgeons, in formations from front to rear. To insure a minimum loss of function to the parts involved, uniform cooperation must be maintained by the Chief Consultant, Surgical Services, during both early treatment and all stages of convalescence.

5. To carry out the provisions of this circular, the Chief Consultant, Surgical Services, will make such provisions as are deemed necessary to insure a complete survey of these cases at regular intervals, and determine if the treatment is progressing in a satisfactory manner. Consultants in orthopædic surgery who are charged with the supervision of such cases within Hospital Centers and other formations will ordinarily be called in consultation for special cases, through the Commanding Officers of the units in question, and the Consultants will report to him prior to completion of their investigations. Commanding Officers of hospitals are expected to freely utilize the services of these consultants in the manner described above. Any recommendations made by them as to change of treatment, or transfer to some other professional service or hospital, will ordinarily, if the military situation permits, receive favorable consideration.

6. It is not the intention of this order to interfere with the routine work of hospitals, but to insure to the soldier proper supervision during the time of his treatment and the period of his convalescence.

M. W. IRELAND,
Brig. Gen. M.C., N.A.,
Chief Surgeon.

A reorganization of professional divisions in the Surgeon General's Office also took place during the summer of 1918. The three Divisions of Surgery, Medicine, and Laboratories, were created, and General Surgery, Head Surgery, Orthopædic Surgery, Roentgenology, and Urology, became sections of the Division of Surgery. Colonel Brackett became the Chief of the Section of Orthopædic Surgery. This is the organization which at present obtains, with Colonel Monerief acting as Chief of the Division of Surgery in the Surgeon-General's Office.

The personnel for the Section of Orthopædic Surgery in the Surgeon-General's Office for the past six months has consisted of the Chief of the Section, Colonel E. G. Brackett; the Assistant Chief, Lieutenant-Colonel David Silver; Orthopædic Consultants to General and Base Hospitals and Camp Inspectors, Lieutenant-Colonel Frank Rugh, Lieutenant-Colonel R. B. Osgood, and Major Peters. Lieutenant-Colonel W. S. Baer and Major Z. B. Adams acted as Consultants for a short time after their return from overseas. There has also been an officer of the Sanitary Division in charge of the Orthopædic Medical Officer personnel, Captain Horace Morrison, numbering at its height, 850, on the

active list and embracing a total enrollment of over 1000. No service has been more important, and none performed with greater efficiency or in a more helpful spirit.

An officer has also been in charge of the orthopædic equipment and supplies; at first Captain J. L. Morse, and later, Captain Henry L. Mann.

Schools for intensive courses in orthopædic surgery have been held in Los Angeles, Omaha, Chicago, Washington, New York, Philadelphia, Oklahoma City, and Boston. Orthopædic surgeons have been assigned to the different National Army camps and base hospitals, to the evacuation and base hospitals organized for overseas service. Orthopædic services were established in the general and base hospitals designated to receive overseas cases. Orthopædic surgeons have been assigned to the ports of debarkation.

This résumé of the work of the different orthopædic services has been prepared by the Section of Orthopædic Surgery with the thought that it might interest many general surgeons and orthopædic surgeons who have either themselves been exempted to the Section of Orthopædic Surgery, or whose assistants or students have been serving as military surgeons under this Section.

The latest classification of conditions considered to be included under the heading of orthopædic surgery has been drawn up by a special committee appointed by the Surgeon-General in December, 1918. This classification is as follows:

1. All cases of amputations.
2. Deformities of extremities due to or associated with contractures of muscles, ligaments, and tendons.
3. Derangements and disabilities of joints; including articular fractures.
4. Deformities and disabilities of the feet.
5. Cases requiring tendon transplantation.

While this classification is not as inclusive as that adopted overseas, it furnishes on the whole perhaps as satisfactory a grouping of cases as could be made for the American hospitals. It overlaps frequently the classification considered as belonging to General Surgery. In a given case with two equally well qualified surgeons, one classed as a General Surgeon and the other as an Orthopædic Surgeon, the criterion as to which service the case belongs may be considered to be the relative importance of the coexisting conditions. For example, if the osteomyelitis connected with a contracture of the muscles and ten-

dons is the important feature in the soldier's recovery, the case would be considered as belonging to General Surgery. If, on the other hand, the joint fracture was the important element, the case would be considered orthopædic in spite of the fact that an unhealed osteomyelitis existed as well.

In general, it is to be said that the chiefs of the surgical services in hospitals have been extremely fair in the distribution of cases. It has been their policy to place the surgeon best qualified to care for the case or group of cases in charge of these patients without regard to the specialty to which he belonged. The main difficulty of the Chief of the Orthopedic Section has been to find for both overseas and America enough orthopedic surgeons who were well qualified to deal with the acute and chronic surgical problems as well as to supervise that detailed and often tedious special treatment which has to do with the return of the greatest amount of function in the shortest possible time.

Before an outline of some of the more important orthopædic services is attempted, it should be said that the cases returning to America presenting bone, joint, and muscle lesions as the result of battle wounds, have shown very conclusively the result of treatment received overseas. In the Army of Great Britain and France, in the early years of the war, the very high percentage of deformities which might have been prevented was truly alarming. The existence of this large percentage in the armies of our allies and the steps taken to prevent their occurrence were known to those in control of our medical department when we entered the war. It must always be a source of great satisfaction to the nation that the cases presenting these potentially crippling lesions which have returned to our home hospitals in America, have shown an almost negligible number of these preventable deformities. In fact, there has been a constant danger that, manned as our home hospitals have been until recently with medical officers without experience with our overseas forces, these deformities would develop in America in the course of the healing of wounds. As has been suggested above, the great value of this system of supervision overseas has been clearly demonstrated and the need of constant watchfulness at home has been emphasized. It has surely been our responsibility to see to it that the wounded soldier did not have an unnecessary burden laid upon him because we failed to appreciate the importance of instituting treatment looking to the attainment of the greatest amount of function as soon as the purely surgical aspects of the cases permitted. This treatment often must be associated with the operative measures undertaken to promote

the healing of the wound and the correction of deformities. It must be a concomitant treatment with the treatment of the wound, and not be postponed until the wound is healed.

Amputations. Early in the war, the French were faced by the problem of providing special numbers of artificial limbs for the mutilés. In the spring of 1915, Professor Tuffier made the statement that the amputations in the French Army at that time numbered 7,000, and that the annual output of artificial limbs in France from the regular commercial manufactory was 700. In Great Britain the same conditions have obtained and it has been impossible to supply well made artificial limbs as quickly as the conditions of the stumps allowed.

There are two very cogent reasons for fitting an artificial limb with a joint mechanism identical with the definitive limb which the soldier is eventually to obtain at the earliest possible moment which the condition of the stump, as far as healing is concerned, warrants. The first of these reasons is, of course, the purely economic one of wage-earning capacity, and affects the body politic. The second reason is that the soldier's initial effort and the early use of the stump muscles overcomes the atrophy of mental effort, and prevents the contraction of the muscles about the stump which leads to unfavorable positions. The plan has been adoped in the medical department of the American Army to supply gratis to the soldier an artificial limb which has all the essential mechanism of his final limb as soon as his stump allows. This limb is known as a "provisional limb" and under conditions of ordinary use, may be expected to last the soldier for a year. It is capable of a very considerable range of adjustment both as to length and, what is of more importance, as to size of socket. The legs which have been used have been made of fibre, are light, and have standard knee joint action. The arms have been made either of fibre or leather, reinforced with steel. The experiment has proved in the main, extremely successful. The men have been promptly fitted to these provisional limbs, have been taught to walk, and have been given special exercises for both arms and legs, and not discharged until a very considerable facility has been obtained.

Unquestionably, this arrangement has saved much time for the soldier and has decreased the time in which he was entirely dependent and possessed no wage-earning capacity. The burden of furnishing the final limb falls entirely upon the War Risk Bureau. This final limb cannot be fitted in case of leg amputation until six months or more have elapsed. The reason for this is that the so-called buckets or sockets

into which the stump fits in the definitive limb of the American type are almost universally made of wood, carefully routed out by hand to an absolute accuracy of fit. Once made, this cannot be materially changed, and if the stump shrinks still more, there must be another complete socket made as carefully as the first, which entails considerable expense and time. With this adjustable socket of the provisional limb, this shrinkage can be taken care of and the stump may be expected to be in a suitable condition for the fitting of a definitive limb several months before the provisional limb is worn out. This margin of time will undoubtedly be of service if, as seems likely, the supply of definitive limbs fails to be adequate to take care of the cases as soon as they are ready for them.

ORTHOPÆDIC AND AMPUTATION SERVICES IN GENERAL HOSPITALS.

Walter Reed General Hospital, Takoma Park, D. C.

This service began to assume important proportions in June, 1918, as the first overseas wounded began to return. Major T. M. Foley acted as the Chief of Service for several weeks and upon his assignment to foreign service was succeeded by Major Albert H. Freiberg as Chief, Major W. D. Erving as first assistant, Captain Carl C. Yount in charge of the amputation service, and Captain Carroll Storey as second lieutenant to the orthopedic surgeon. More and more wards were gradually assigned to the orthopedic service as the cases increased on rather a broad classification of bone and joint conditions.

In the early part of the service, there were many purely static conditions coming in from the surrounding camps and one of the most active parts of the work consisted in rehabilitating soldiers with weak and flattened feet. Lieut. Goldblatt's work in this connection should be especially mentioned.

Here, also, was worked out the outline for a standardized plan of organization of an orthopedic service of 250 beds or over. This standardized plan has been followed with practically no change in all the orthopedic services, in which, as sections of the Surgical Service in the General Hospitals, they have numbered over 250 patients. Along with this outline was sent an operative technique for orthopedic cases, meticulous, but less exacting perhaps than the British orthopedic technique, though an attempt was made to incorporate the essential features of the British scheme.

At the Walter Reed the amputation service soon assumed a very important place, which it has always retained. Over 800 cases of amputation have been in the wards of the Walter Reed Hospital at one time. Since it was the first amputation center to receive large numbers of cases, it has been here that the plan of provisional limbs, conceived by Lt. Colonel Silver, in charge of the amputation work, has been worked out.

Colonel Silver has acted as consultant to the Walter Reed Hospital in connection with the amputation work, and Major Kendall Emerson has been in active charge of the organization of this section, nominally carried on the rolls of the Surgeon General's office, but really spending almost all his time at the Walter Reed Hospital, operating upon the stumps which needed more surgery, devising methods of hastening healing, and with Major Yount, elaborating the details of the fitting of the provisional limbs and working out special appliances for the arm cases.

Major Yount, in charge of the appliance shop, has devised what seems to be the most practical terminal plate appliance for upper extremity amputations. To this end plate can be fastened very quickly, easily and securely, any form of hand-grasping device or recreation device, such as tennis-racket or ping-pong paddle.

After the armistice, Major Freiberg was relieved of duty at his own desire, and Major Erving assumed charge of the service, with Captain John O'Ferrall as assistant chief of the section. Captain Yount was in charge of the amputation section, with Major Emerson in constant attendance in a supervisory capacity.

The service in these days numbered over 1200 patients. Various reorganizations of the Walter Reed took place during the late winter and early spring, while Lt. Col. Edward Martin and Colonel Astley Ashhurst were acting as chief of the surgical service. This resulted in an entirely new distribution of cases. The amputation service still remained under Captain Yount, but nearly all the cases of osteomyelitis, and indeed many of the bone and joint cases requiring surgical attention, were divided into groups and placed under different medical officers, some belonging to the orthopedic section and some to the general surgical section. This new arrangement resulted in cutting down very materially the size of the orthopedic service *per se*.

At the Walter Reed, there has been most satisfactory coöperative endeavor between the orthopedic service and the reconstruction division, and very serious and more or less successful attempts have been made to perfect the curative side of the occupational shops. At the time of the present writing, the orthopedic staff at the Walter Reed Hospital numbers 19. Colonel Glennan has recently been made commanding officer of the Walter Reed, and Colonel Kellar, Regular Army, chief of the surgical service, Colonel Allison and Major Danforth have been assigned to the Walter Reed on the orthopedic service. Major Philip Wilson has been given full charge of the amputation section. On April 1st, there were 1154 overseas patients at the Walter Reed Hospital.

In April the following men were serving on the orthopedic section of this hospital:

Lt. Jas. H. Allen,
Lt. Loren F. Carter,
Lt. Jas. G. Denelsbeck,
Lt. Walter L. Denny,
Lt. Wm. O. Hill,
Lt. Louis J. Livingood,
Lt. Leland E. Phipps,
Lt. Hall Shannon,
Lt. Henry T. Simon,
Lt. Frank G. Walz,
Lt. Barron Johns,
Capt. J. R. Tilletson,
Capt. Carl C. Yount,
Major M. Mobley,
Major P. D. Wilson,
Major M. S. Danforth,
Colonel Nathaniel Allison.

Letterman General Hospital.

Crossing the continent now, we come to the Letterman General Hospital, which was one of the Regular Army Hospitals before the war, beautifully situated in the Presidio, San Francisco, overlooking the Golden Gate. In the early summer of 1918, Major R. L. Hull of Oklahoma City was assigned as orthopedic surgeon, and on the visit of the consultant in September, two wards were entirely given up to orthopedic cases, although no overseas cases had arrived.

Major Hull's personality made his service a most happy one. His mature judgment, his excellent operative ability, and his wide experience, added to a rather remarkable executive and administrative faculty made him an extremely valuable person in the hospital.

As soon as the overseas cases began to arrive, the service grew more rapidly, absorbing more and more wards. Major Hull became the supervisor of the physio-therapeutic work, embracing hydro-therapy and massage. At the Letterman there has been, for a considerable time, a rather elaborate hydro-therapeutic plant and this treatment has been one of the features of the hospital in charge of a sergeant, excellently trained by long experience in European spas.

Letterman also, has been designated as an amputation centre. Major Hull's very sad death from influenza and pneumonia in January, represents a loss not only to the service of the Letterman Hospital, where he had made himself respected and loved to a very unusual degree, but to the whole surgical profession. Fearless and kindly, firm yet extraordinarily gentle, he won everyone's heart, and made it possible for the specialty which he represented to perform an extremely useful service.

Major Hull was succeeded by Major Leo Eloesser, who had a wide experience in the German hospitals abroad, especially along orthopedic and prosthetic lines. He brought to the service this wide training and great energy. Under his leadership, both the amputation and the general orthopedic services have increased in importance. He has devised in the appliance shop a special form of artificial limb which bids fair to be almost as durable as the final definitive limb which the War Risk Bureau expect to furnish. This limb, known as the "Letterman Leg," is constructed on somewhat different principles than the common type of the American limb, getting its grip above the condyles of the femur and being really suspended from this point quite as much as from the shoulder strap of the ordinary type. The leg is being given a thorough trial.

Captain S. L. Haas had been first assistant to Major Hull, and is now to Major Eloesser. His very broad training as a surgical pathologist whose attention has been directed chiefly toward the problems of the growth of bone, and to joint work, has made him an unusually valuable man to the service. Captain Haas' service at Letterman has been interrupted by his coming to Washington to organize the Laboratory of Surgical Pathology at the Army Medical Museum. At the time of the present writing the orthopedic staff at the Letterman General Hospital numbers 17. On April 1st there were 772 overseas patients at the Letterman General. The following men were serving on the orthopedic section at this hospital:

Capt. John I. Boyer,
Lt. Chas. A. Craig,
Lt. Linwood Dozier,
Major Leo Eloesser,
Capt. S. L. Haas,
Capt. Herman V. Hoffman,
Lt. Alva F. Maine,
Lt. T. J. Nolan,
Lt. Victor L. Roche,
Lt. Arnold M. Scholz,
Capt. John Thos. Whitty,
Lt. Col. Chas. F. Eikenbary,
Lt. Col. W. I. Baldwin,
Lt. John Swancett.

U. S. A. General Hospital No. 1, Williamsbridge, N. Y.

The hospital at Williamsbridge has been under the officer of the port of Hoboken, and not directly under the Surgeon General's office, but has been functioning as a General Hospital, and still continues to so function.

The orthopedic service in this hospital has been in the hands of Captain Merritt L. Jones, formerly of Boston. Until the overseas cases began to arrive, the service was comparatively small, but noteworthy. Captain Jones has worked out numerous simple exercising machines, applicable to cases of foot-strain and extremely useful in the mobilization of partly ankylosed joints. Since the advent of the overseas cases, the service has increased in importance. While there has been no very sharp demarkation by wards between the orthopedic and

general surgical cases, Captain Jones' services have been utilized to a very large extent and almost all bone and joint cases and cases in which the restoration of function was the important factor, have been referred to him. Captain Jones has been the only member of the staff exempted to orthopedic surgery at U.S.A. General Hospital No. 1, Williamsbridge, N. Y. Several valuable critical reviews of groups of cases have been written by Captain Jones for publication.

On April 1st, there were 832 overseas cases at No. 1.

U. S. A. General Hospital No. 2, Fort McHenry, Md.

The orthopedic service at Fort McHenry in February, 1918, was assigned to Major S. C. Baldwin. He maintained his post until November, 1918, when he was assigned to the Port of Hoboken, and was made director of surgery of the port. He was succeeded by Major Guy C. Boughton. Overseas cases began to increase in number at Fort McHenry very rapidly, until on April 1st, 1919, there were more overseas cases at Fort McHenry than at any other U.S.A. hospital except Fort Sheridan.

After the sad death of Major Bissell, chief of the surgical service, Major A. R. Colvin of the orthopedic section was assigned to Ft. McHenry as the chief of the surgical service, Major Boughton still functioning as orthopedic surgeon. In February, Major Boughton was assigned to U.S.A. General Hospital No. 36, at Detroit, and Major A. R. Graves became orthopedic surgeon and has conducted the service with great distinction up to the present time.

A large Neuro-surgical service has developed here, and has many points of contact with the orthopedic section.

The orthopedic staff at U.S.A. General Hospital No. 2, at the present writing, is as follows:

Lt. Walter Thomas Anderson,
Capt. Edward W. Burt,
Capt. G. B. Capite,
Major Sydney M. Cone,
Lt. R. L. Cook,
Lt. John Dane,
Major R. J. Graves,
Lt. T. M. Hart,
Lt. Raymond L. Johnson,
Lt. Geo. V. Lynch,
Lt. Anthony Mangiaracina,
Lt. John Revington,
Lt. H. L. Snaffer,
Capt. Louis I. Skirball,
Major R. T. Taylor,
Major A. H. Parsons,
Capt. Clark Kimball Peterson,
Capt. Eben W. Fiske,
Lt. Norman W. Gillespie,
Capt. I. J. Parsons,
Lt. John A. Key,
Major I. W. Livermore.

U.S.A. General Hospital No. 3, Colonia, N. J.

The general hospital at Colonia was started as a project soon after the beginning of the war, stimulated by the very generous offer of Mr. and Mrs. Charles Freeman to allow the Government to use their beautiful estate for building a hospital. The hospitals division of the surgeon general's office accepted this offer and construction began during the winter of 1917. Toward the end of the summer a plant of 1600 beds was ready, embracing curative shops and educational buildings, hydro-therapy and electro-therapy and massage rooms, as well as an unusually efficient operating and x-ray plant.

Major F. H. Albee became chief of the surgical service when the hospital finally began to receive patients in the fall of 1918, and has continued as chief of the surgical service ever since. This hospital being near the port of debarkation, it was from the beginning designated as an amputation and bone and joint centre. With the exception of the Walter Reed, more cases of amputation have been sent to Colonia than to any other hospital.

Occupational work has been developed at Colonia to a very extraordinary extent. Very exquisite articles have been made, embracing leather and wooden

articles of unusual design. They have greatly stimulated the patients' originality. A wave of interest in this work may be said to have swept the hospital and a very large percentage of the patients are engaged in some form of occupational work which is of a distinctly educational or decorative value.

The reconstruction work in general, under Major Johnson, has been most successfully organized.

There were on April 1st, 1452 overseas cases at Colonia. In April the following men were serving on the orthopedic staff of the hospital:

Major F. H. Albee,	Lt. George Y. Massenburg,
Capt. Thomas D. Buck,	Lt. H. F. Morrison (rec. dis.),
Lt. H. E. Bundy,	Lt. A. B. Pemsler,
Major Harold D. Corbusier,	Capt. Edw. J. Rose,
Lt. D. A. Curtis,	Lt. C. N. Silman,
Capt. J. Spencer Davis,	Lt. Elmer P. Weigel,
Lt. S. H. Easton,	Capt. L. B. Zintsmaster,
Lt. J. M. Gilchrist,	Major F. B. Van Wart
Lt. John G. Hart,	Major Henry C. Marble,
Lt. Ezra A. Jones,	Capt. Francis J. A. Bennett,
Lt. Armin Klein,	Capt. H. P. Mauck,
Lt. Thos. L. McNamara,	Lt. D. F. Elmendorf.

U. S. Army General Hospital No. 5, Ft. Ontario, N. Y.

U.S.A. General Hospital No. 5, Ft. Ontario, at Oswego, New York, is somewhat isolated from contact with other hospitals. Captain Philip D. Bunce has been quietly and most efficiently working as orthopedic surgeon at U.S.A. General Hospital No. 5.

The advent of more overseas cases has led to a very definite increase in the amount of his work, and an assistant orthopedic surgeon, Lieut. L'Episcopo, has been assigned. On April 1st there were 493 overseas cases at General Hospital No. 5.

U. S. Army General Hospital No. 6, Fort McPherson, Ga.

Fort McPherson was one of the earliest of the general hospitals to specialize in orthopedic work, and while at first this consisted largely of foot-strain, back-strain and other static conditions received from the neighboring camps, it gradually developed into a very active service under the direction of Lieut. J. R. Jones.

As overseas cases began to arrive, Capt. J. B. Woodman and Captain J. C. Wilson were assigned to Fort McPherson, and Lieut. Jones was sent overseas as orthopedic surgeon to an evacuation hospital.

Captain Woodman, on account of his surgical ability, served as assistant to Lieut.-Colonel Babcock, who had been made chief of the surgical service. In August, Captain Woodman was made commanding officer of a base hospital, and sent overseas,—Captain Wilson has remained as chief of the orthopedic section at this post up to the present time.

The service has been very active and a very large one, including bone, joint, and muscle cases. Captain Wilson has shown unusual surgical ability.

At Fort McPherson, there has been an amputation centre, at first supervised entirely by Captain Wilson, and later by Captain Oscar R. Miller, acting, of course, under the orthopedic surgeon. Captain Miller has recently been discharged and his place taken by Captain Thomas V. Magruder, who in turn has been succeeded by Captain Marcus Skinner. On April 1st there were 1372 overseas cases at Fort McPherson.

In April the following men were serving on the orthopedic section of this hospital:

Lt. Lee Brady (dis. rec.)
Lt. Clarence Henry Hyman,
Lt. Clarence A. Jacobson,
Capt. T. E. Wilkenson,
Lt. George B. Lynch,
Capt. Thomas V. Magruder,
Capt. Gilbert M. Mason (rec. dis.),
Capt. R. C. Robinson,
Lt. Raymond E. Watkins,
Capt. John C. Wilson,
Lt. C. M. West,
Capt. W. F. Collins.

U. S. Army General Hospital No. 9, Lakewood, N. J.

The development of the orthopedic service at Lakewood, N. J., is due almost entirely to the ability and energy of Capt. E. W. Cleary, who has been acting as orthopedic surgeon here since early summer of 1918. There was in the early days of the service the closest coöperation between Major Cleary and the chief of the surgical service, Major Halsey Thomas.

The distribution of cases was made in consultation and no sharp line was ever drawn, emphasis being placed upon the importance of the return of function. Those cases in which this conservation of function seemed to be the important element, were considered to be orthopedic in type.

At Lakewood, the coöperation between the reconstruction division and the orthopædic section has also been very close. Major Reagle was the first reconstruction officer here, and to his force and resourcefulness is due the fact that a very large percentage of the patients are engaged in some form of reconstruction activity.

Captain Cleary has devised several very ingenious and practical pieces of apparatus which he has carefully tried out before determining upon their final form. An abduction arm splint and an elbow splint for increasing motion in either extension or flexion are distinctly original in their type. The cases here have been of a somewhat lighter type than in many of the other orthopedic centers, since the hospital is listed to receive only a few bed cases on account of a supposedly considerable fire risk. On April 1st there were 643 overseas cases at General Hospital No. 9.

The following men were serving on the orthopedic section of this hospital in April:

Lt. Pio Planco,
Lt. O. W. Butler,
Capt. E. W. Cleary,
Lt. W. F. Cotting,
Lt. Howard B. DuPuy,
Lt. Robert Goodman,
Lt. Dudley J. Morton,
Lt. Arthur F. Sergent,
Lt. Thomas B. Rafferty,
Lt. Joseph F. O'Brien,
Lt. Norman McL. Dingman,
Capt. J. H. Galbraith,
Lt. Col. A. H Cilley.

U. S. Army General Hospital No. 10, Boston, Mass.

In Boston, early in the war, the fraternal order of Elks became interested in building a hospital for reconstruction and other surgery, which would be turned over to the Government for the period of the war, and maintained after the war as a permanent hospital for this type of chronic surgery. A site was finally chosen on top of Parker Hill, next to the Robert Brigham Hospital. After the project developed, an arrangement was made with the trustees of the Robert Brigham hospital to include this in the plant for the duration of the war. The arrangement was a very happy one, since the equipment of the Robert Brigham, designed for chronic cases, was unusually good, both as to operating room facilities, x-ray plant, and physio-therapeutic department.

Major Frederic J. Cotton, originally exempted to orthopædic surgery, has been chief of the surgical service since the opening of the hospital. He was released to general surgery while acting as chief of the surgical service in the Walter Reed Hospital. His long interest and wide experience in bone and joint con-

ditions fit him especially for this post, since a very large proportion of the surgical cases sent to No. 10 are operative in type. In addition to the old plant of the Robert Brigham Hospital, and the new hospital plant proper, built by the fraternal order of Elks, the Government has taken over the buildings of the parental home in West Roxbury, which furnishes convalescent beds for 400 more cases.

U.S.A. General Hospital No. 10 is designated as a neuro-surgical centre and an amputation centre. There were on April 1st 674 overseas cases in Boston.

In April the following men were serving on the orthopedic section of this hospital:

Lt. Marshall L. Alling,
Capt. Louis A. Bolling,
Capt. John Brooks,
Capt. Wm. A. Clark,
Lt. Wm. H. Halley,
Lt. H. L. Keim,
Lt. Wm. G. McCormack,
Lt. Frank W. Marvin,
Lt. Nathaniel Mills,
Capt. C. E. Pannaci,
Lt. T. L. Story,
Lt. Arthur M. Washburn (rec. dis.),
Lt. James Blaine Montgomery,
Capt. A. A. Fenton.

U.S.A. General Hospital No. 11, Cape May, N. J.

U. S .A. General Hospital No. 11 at Cape May has been designated to receive cases of deafness, cases requiring oro-plastic surgery, and neuro-surgery. Major Chas. Frazier has been chief of the surgical service at Cape May, and chief consultant in America in neuro-surgery. There has been a small but very useful orthopedic service at Cape May under Major Roades Fayerweather.

Lt. Burkie has devised various simple light forms of hand and foot splints which deserve special mention. They can be made up in large numbers, are almost universal in their fit and are extremely efficient in their mechanical action. On April 1st there were 591 overseas cases at General Hospital No. 11.

U. S. A. General Hospital No. 12, Biltmore, N. C.

U.S.A. General Hospital No. 12 has had practically no orthopedic cases, although it was originally expected that it would be designated to receive them, and Major S. Fosdick Jones, who had returned from work overseas, was assigned to this hospital as orthopedic surgeon. His work has been extremely valuable, although not along orthopedic lines. A large number of empyema cases were congregated here and placed under his charge. He also has been acting chief of the surgical service part of the time, and has been one of the men upon whom the commanding officer has depended for administrative work in the hospital. At present there is no orthopedic service or orthopedic surgeon at Biltmore.

U.S.A. General Hospital No. 14, Fort Oglethorpe, Ga.

It was expected that Ft. Oglethorpe would serve as an important teaching hospital, and while the courses in the medical officers' training camp were going on, it did so serve. Various orthopedic surgeons have been connected with the medical officers' training camp at Fort Oglethorpe and with the General Hospital.

Major John Ridlon, Major Edwin Ryerson, Major Nathan, Lieut. Dudley Morton, have all taken part in the orthopedic activities. At present the hospital has a comparatively small number of overseas cases and it has not been found necessary to establish a distinct orthopedic section.

U.S.A. General Hospital No. 22, Philadelphia, Pa.

U.S.A. General Hospital No. 22 was one of the last general hospitals to be established as the demand for the reception of cases whose homes were in

this region became more insistent. Here, too, have been a comparatively small number of overseas cases, the orthopedic work at first being under the direction of Lieut. Colonel Rugh, assisted by Lt. Wm. C. Ely, and later under Major DeForest Willard, who brings to the service wide overseas experience gained in many positions of great responsibility and importance.

U.S.A. General Hospital No. 24, Parkview Sta., Pittsburgh, Pa.

U.S.A. General Hospital No. 24, was opened as a general hospital in the late winter with an orthopedic service which has grown to be of considerable importance. The chief of the orthopedic service has been Captain D. H. Moore and with him has been Lt. Geo. E. Cramer. On April 1st there were 485 overseas cases at Parkview.

In April the following men were serving on the orthopedic section of this hospital:

Lt. Geo. E. Cramer,
Lt. Albion A. Cross,
Capt. B. H. Moore,
Lt. N. A. Wolff,
Lt. Simpson.

U.S.A. General Hospital No. 25, Ft. Benj. Harrison, Ind.

U.S.A. General Hospital No. 25 has been designated as a hospital to receive epileptics and mental defectives, but during the winter a certain number of overseas cases were sent here, including a good many important bone and joint lesions. It was thought best to establish a small orthopædic service at Ft. Benjamin Harrison and Major Neal S. McDonald and Captain P. P. Haslett were assigned. Very few additional bone and joint cases have been assigned to General Hospital No. 25 and Major Haslett has been transferred to General Hospital No. 32, Chicago, Ill.

U.S.A. General Hospital No. 26, Ft. Des Moines, Iowa.

U.S.A. General Hospital No. 26 has been one of the largest and most important orthopedic centres since its inception. Originally Major John Prentiss Lord was the orthopedic surgeon and upon his retirement from active service Major J. L. Porter of Chicago became chief of the section. The hospital has been designated to receive both amputation and neuro-surgical cases, and has always had a large number of overseas cases. The orthopedic service has been very large and efficient. There have always been most cordial relations between the orthopedic section and the general surgical section. Major M. B. Tinker, himself a most able bone and joint surgeon, has been chief of the surgical service and has taken keen interest in all the bone and joint problems, the conservation of function, and the prevention of deformities during the course of healing. The service is still running very large and the results have been extremely satisfactory. There were on April 1st 904 overseas cases at Ft. Des Moines. Capt. Baldwin, assigned to the amputation service, has designed an admirable adjustable paper socket.

Sixteen orthopedic surgeons have been associated with the service at Ft. Des Moines, as follows:

Lt. John E. Bentley,
Capt. R. D. Kennedy,
Lt. L. M. Maitland,
Lt. John Mitchell,
Capt. L. C. Nickell,
Lt. Col. Hiram W. Orr,
Capt. T. G. Orr,
Lt. H. L. Prince,
Major John L. Porter,
Lt. E. N. Roberts,
Capt. C. A. Warner,
Lt. J. E. Wattenberg,
Lt. J. R. Young,
Capt. Chas. Elroy Llewellyn,
Lt. James F. Hanna,
Capt. A. B. Phillips,
Major R. V. Smith.

U.S.A. General Hospital No. 28, Fort Sheridan, Ill.

The hospital at Fort Sheridan has been planned as the largest general hospital in the Army. 4800 beds have been provided. Most of the wards are of two story cantonment type, constructed with covered connecting corridors. The old post barracks have been converted also into most excellent wards and administrative offices, and the orthopædic section is housed in the main in these former post buildings. A cantonment structure ward in close geographic relation to the operating suite makes it possible to conduct an active operative service efficiently. Colonel Dean Lewis is chief of the surgical service and his long interest in reconstruction surgery and tendon work has given him a great appreciation of the importance of the chronic bone and joint surgery. Colonel Lewis is devoting most of his attention to neuro-surgery, a large and important group of these cases having been assigned to General Hospital No. 28. Major Edwin W. Ryerson has been acting as orthopedic surgeon at Fort Sheridan since it was opened, having been transferred to this hospital after the closing of the medical officers' training camp at Fort Oglethorpe, where he had been head of the orthopædic school. With him have been associated 15 orthopædic surgeons caring for the service, which has steadily increased in size and been unusually well organized. The work which Lt. John F. McNary has done in the study and recording of the peripheral nerve cases before they were turned over to the neuro-surgical services deserves special mention. On April 1st there were 1819 overseas cases at General Hospital No. 28.

In April the following men were serving on the orthopedic service of this hospital:

Lt. E. J. Barkheiser,
Capt. T. B. Cracroft,
Capt. H. C. Dozier,
Capt. E. B. Fowler,
Capt. Emil Hoglund,
Lt. Yngre Joranen—Medical,
Capt. Albert B. McQuillan,
Lt. John F. McNary,
Capt. Rudolph S. Reich,
Major E. W. Ryerson,
Lt. J. A. Saari,
Capt. John D. Trawick,
Capt. Chas. Wilbur Mercer,
Capt. J. A. Holgren,
Lt. P. B. Greenberg,
Maj. Ralph Kaysen,
Capt. L. J. Quillin,
Lt. Arthur S. Sandler,
Capt. A. N. Wiseley,
Capt. Herman Schuman.

U.S.A. General Hospital No. 29, Ft. Snelling, Minn.

U.S.A. General Hospital No. 29 was opened in the Fall of 1918, at Fort Snelling at the confluence of the Minnesota and Mississippi Rivers at the cite of the famous old Ft. Snelling post. It is most attractively placed. The orthopedic surgeon since the opening of the hospital has been Major E. A. Rich. With great energy he has developed the service to a point of great usefulness. One of the remarkable features of his service has been the success which he has had in focusing the attention of the soldiers upon their recovery. A daily schedule of occupation and therapy was established in all the wards. Recreation itself even was planned, and talks on the history of the region were given. The policy of the government in relation to the future care of the men was outlined in lectures, and matters of general Army interest were discussed. There has been a great deal of bone and joint work and a service of very large size. An amputation service has been established at Fort Snelling and the fitting with provisional prostheses has been very speedily done owing to the close proximity of the Minneapolis Artificial Limb Company, who have a contract with the Government for the fitting of these provisional limbs. The occupational and reconstruction work at Ft. Snelling has been

developed very extensively and most cordial help in all occupational matters and in special furnishings for the hospitals have been given by the cities of St. Paul and Minneapolis, between which the Fort is situated. On April 1st there were 770 overseas cases at General Hospital No. 29. Major Rich has lately been discharged and Lt. Col. James C. Graves has been appointed orthopedic surgeon.

In April the following men were serving in the orthopedic section of this hospital:

Lt. Walter C. Aylen,
Lt. L. J. Brockman,
Capt. Chas. F. Clayton,
Lt. M. S. Davis,
Lt. Michael A. Desmond,
Lt. R. K. Finley,
Lt. Floyd D. Gillis,
Capt. E. A. Klein,
Capt. Jos. R. Kuth,
Capt. C. J. McCusker,
Lt. E. S. Porter,
Lt. Walter G. Sexton,
Lt. James Glowisley Walker,
Lt. Joseph Herbert Wolfe,
Lt. Col. J. C. Graves.

U.S.A. General Hospital No. 31, Carlisle.

It has been hoped that at Carlisle a specially efficient reconstruction hospital could be established, for the plant of the Carlisle Industrial School lends itself in an unusual way to this work. Shops of almost every description, which are well adapted for curative shops, are already established. Capt. R. V. A. Bliss has been orthopedic surgeon. The hospital has been open since the middle of the winter. On April 1st there were 655 overseas cases in this hospital.

In April the following men were serving in the orthopedic section of this hospital:

Capt. R. V. A. Bliss,
Capt. Scott A. Norris,
Lt. K. C. Peacock.

U.S.A. General Hospital No. 32, Chicago, Ill.

U.S.A. General Hospital No. 32 was opened late in January. It is situated at Drexel Avenue and 47th Street, adapted from the Cooper-Monotah Building, which was planned for a hotel. The property was taken over before the hotel had been entirely divided into small rooms and thus two large wards of 60 and 80 beds respectively were made possible. A few smaller wards of 10 or 12 beds were arranged, the rest of the hospital consisting of two or three bed wards. A small Zander room and a small gymnasium have been equipped. There are practically no reconstruction activities in connection with the hospital, but arrangements have been made whereby patients may receive instruction in one of the city manual training schools under very excellent instructors.

Lt. Colonel Vanamee has been orthopedic surgeon here, most ably assisted by Major Bacon, whose general surgical experience has been large and whose attention to the restoration of functions has been most constant. On April 1st there were 375 overseas cases at General Hospital No. 32.

In April the following men were serving in the orthopedic section of this hospital:

Major L. W. Bacon,
Lt. G. M. DeBeck,
Lt. H. S. Edson,
Capt. A. S. Lowenthal,
Lt. Michael F. McGuire,
Lt. Col. T. C. Vanamee,
Capt. P. P. Haslitt,
Capt. Carl Paulson.

U.S.A. General Hospital No. 35, West Baden, Ind.

U.S.A. General Hospital No. 35 is situated in the property of the former West Baden Hotel, advertised as the "Carlsbad of America." The former hotel is arranged in the form of a circle, 6 stories of double tier rooms surrounding a huge atrium surmounted by an enormous dome. While the original property did not lend itself well to hospital purposes, the adaptations which have been made have been very skillfully planned by the commanding officer, Colonel Bliss, and have resulted in an excellent working plant. All possible diversional opportunities have been given the men at West Baden in the bowling alleys, shooting galleries, swimming tanks, etc., of the old hotel property.

Captain Percy Roberts has been acting as orthopedic surgeon at West Baden and Major Halsey W. Thomas, formerly of U.S.A. General Hospital No. 9, Lakewood, N. J., has been chief of the surgical service. This hospital is to be discontinued on June 1st. On April 1st there were 213 overseas cases at West Baden.

In April the following men were serving on the orthopedic section of this hospital:

Capt. Jos. O'Dwyer, Capt. A. N. Wiseley (rec. dis.).

U.S.A. General Hospital No. 36, Detroit, Mich.

U.S.A. General Hospital No. 36, has been an interesting development. It has been established in the old and new buildings of the Ford Hospital. The plant of the old hospital furnishes an absolutely modern, completely equipped operating suite, laboratory, etc. The new hospital, connected by an underground tunnel with the old hospital, was originally planned to be of the hotel type with separate rooms and very small wards, to accommodate about 500 private patients. The Government, however, has adapted it so that many of the partitions were omitted and large wards arranged, with a corresponding increase in the number of beds totaling now about 1400. These, at the present time, are not all available, since construction has been somewhat delayed. The capacity is rapidly approaching the maximum under the energetic administration of the commanding officer, Colonel Cooper. Major Guy C. Boughton was the first orthopedic surgeon at General Hospital No. 36, and organized the service. He was replaced by Major F. C. Kidner late in February, who brought to the service very wide experience in the orthopedic centres in England. During the last part of Major Kidner's stay in England he was consulting orthopedic surgeon for all the American hospitals in England. In April there were over 500 overseas cases at General Hospital No. 36.

In April the following men were serving on the orthopedic section of this hospital:

Lt. I. I. Bittker,
Lt. Jacob H. Chalat,
Lt. L. B. Cowen,
Major F. C. Kidner,
Capt. Thos. S. Mebane,
Lt. Rudolph H. Ruedemann,
Capt. Carrol L. Storey,
Capt. S. E. Risendorff,
Maj. Geo. T. Hodgen,
Lt. Frank P. McCarty.

U.S.A. General Hospital No. 38, Eastview, New York.

General Hospital No. 38 at Eastview, New York, was opened in January, 1919, and late in March had over 600 overseas cases. They have in the main been of the less severe type. Major John Homans has been chief of the surgical service, and Major Clarence Coon the orthopedic surgeon, assisted by Lieut. Epstein.

U.S.A. General Hospital No. 41, Fox Hills, Staten Island, N. Y.

U.S.A. General Hospital No. 41, long functionated as a debarkation hospital. The chief of the surgical service has been Major Robert E. Soule. He has now assumed charge of the orthopedic work, since the hospital has become a general hospital, and a far greater scope will be given to his recognized ability as orthopedic surgeon. It is planned to make Fox Hills a very important general hospital. It has been designated as a center for neurological surgery. On April 1st there were 1315 overseas cases at U. S. General Hospital No. 41. The following orthopedic surgeons have been assigned to Fox Hills:

Major Robert E. Soule,
Lt. Chas. D. Reid, Jr.
Capt. Edward L. Cooley.

EMBARKATION AND DEBARKATION HOSPITALS.

Orthopedic surgeons have been on duty at the embarkation hospitals in New York and Newport News inspecting the troops and serving also, since overseas wounded have been arriving, as supervisors of splinting on the transports before the cases were debarked.

When the cases first began to be transported there was a good deal of difficulty experienced because of the failure of the surgeons on the transports to realize the importance of maintaining fixation until the patients landed. The soldiers would often request to have the splints removed and their condition not being acute, the surgeons would frequently comply with these requests and in many instances unnecessary shortening and preventable deformities occurred. This difficulty was also experienced in the debarkation hospitals until surgeons who had had no overseas experience began to appreciate the fact that with these chronic bone injuries, accompanied by infection, union was very much slower than with simple fractures and that the calluses were much softer and more mouldable. Orthopedic surgeons were, on this account, sent to the ports of debarkation and a more careful supervision of splinting was instituted, both before the cases were removed from the transports and while under treatment in the debarkation hospitals. This has resulted in a very much more satisfactory condition as to splinting which obtains at present. The cases arrive at the general or base hospitals as a rule well splinted.

The principal embarkation hospitals have been at the ports of Hoboken and Newport News. Debarkation hospitals have also been established at these ports. Debarkation Hosptial No. 52, at Richmond, Va., has now been abandoned, but Debarkation Hospital No. 51, at Hampton, Va., in the buildings of the Old Soldiers' Home, still functionates. Debarkation Hospital No. 2, at Fox Hills, Staten Island, has now been changed to General Hospital No. 41. Debarkation Hospital No. 1, Ellis Island, N. Y.; Debarkation Hospital No. 3, at Greenhut Building, N. Y.; Debarkation Hospital No. 4, at the Polyclinic in New York; and Debarkation Hospital No. 5, at the Grand Central Palace in New York, are still being maintained at the writing of this article. To these hospitals have been assigned the following personnel:

D. H. No. 1, Ellis Island,
Lt. Edwin H. Spies.
D. H. No. 3, Greenhut Bldg, N. Y.
Capt. J. L. Bendell,
Lt. Frederick Gardner.
D. H. No. 4, Polyclinic, N. Y.,
Capt. Robt. M. Yergason.
D. H. No. 5, Grand Central Palace, N.Y.
Lt. Leonard P. Bland,
Lt. Geo. W. Cramm,
Lt. Chas. W. Bruninghaus.
B. H. Camp Merritt, N. J.,
Lt. Morris T. Koven.
B. H. Camp Mills, N. Y.,
Capt. E. R. Kelsey.

General assignments of the following orthopedic men have been made to the surgeon at the port of Hoboken for their assignment as he considers wise:

Major S. C. Baldwin,
Director of Surgery of the Port.
Lt. Col. G. W. Hawley,
Major R. D. Shrock,
Lt. George L. Chaffin,
Lt. Russell Pemberton,
Lt. Milo T. Easton,
Lt. Chas. A. Wisch,
Lt. F. B. Ring,
Lt. Chas. Goldman,
Major Geo. J. McChesney,
Major Wm. B. Carroll,
Lt. W. W. Lasher,
Major C. D. Napier,
Capt. D. C. Paterson.
Capt. L. N. Harris.

At Debarkation Hospital No. 4, Lt. Colonel George W. Hawley, assisted by Major Schrock and Captain Todd, has organized a special surgical clinic after the plans of Dr. Pietro Chutro, formerly of Paris. Dr. Chutro's bone work, especially on osteomyelitis, has been considered by many to be the most successful of any work overseas. He follows a special technique, and has his operating room specially organized. Dr. Chutro is to visit America and demonstrate his methods at Debarkation Hospital No. 4. Colonel Hawley is familiar with all these methods and is preparing for this visit. The clinic will be opened to all army surgeons.

Base Hospitals.

It will be impossible within the limits of this paper to do justice to the orthopedic activities in all the base hospitals. Only a few, therefore, will be mentioned which have been of considerable size and are contributing much to the welfare of the overseas patients.

Camp Devens, Mass.

At Camp Devens, the service was formerly under the care of Major Schirmer. He was transferred to Camp Meade in January, and Captain Fitzsimmons was made orthopedic surgeon. An excellent spirit of team play exists and an important service has been built up. On April 1st there were 576 overseas cases in Camp Devens.

In April the following men were serving on the orthopedic staff at Camp Devens:

Base Hospital.	Camp.
Capt. H. J. Fitzsimmons,	Lt. Charles L. Kerrick,
Lt. W. E. Clarke,	Lt. Harold Thomas,
Lt. R. S. Perkins.	Capt. Harold L. Burr,
	Capt. P. H. O'Conner.

Camp Dix, N. J.

The orthopedic work at Camp Dix was originally in charge of Captain Meisenbach who was discharged from the service soon after the overseas cases began to arrive. He was succeeded by Major Davidson, who, in turn was succeeded by Major McClain and Captain W. J. Merrill. The operative work has been quite extensive and a most interesting collection of bone and joint cases has been sent here.

The number of overseas cases in this hospital on April first was 1207. The following men were serving on the orthopedic staff at Camp Dix in April:

Base Hospital.

Major Alvah S. McClain,
Capt. Wm. J. Merrill,
Capt. J. L. Moriarty,
Lt. E. N. Y. Kau,
Capt. J. A. Board,
Capt. Carl Ryden.
Capt. Carson Coover,
Lieut. Thomas L. Smyth,

Camp.

Lt. Clarence F. Fowler,
Capt. John C. Herrick,
Lt. R. C. Hooker,
Lt. Herman M. Hurwitz,
Lt. S. B. Pearce (dis. rec.),
Lt. J. L. Linn,
Lt. C. A. Lee,
Lt. J. W. Smith.

Camp Meade, Md.

The orthopedic work at Camp Meade increased rather suddenly and required much operative attention. Lt. Colonel Ralph Fitch was assigned here on his return from overseas and met the emergency splendidly. After his discharge from the service, Major Schirmer became orthopedic surgeon. He, in turn, has been discharged. Recently a separate service has been organized by Major Billington, whose experience overseas especially well fits him for helpful service with bone and joint cases. The service is large and important. Lt. Colonel Lane, chief of the surgical service, takes keen interest in the functional treatment during the course of wound healing, and special curative work is being planned in the shops.

On April 1st there were 804 overseas cases at Base Hospital, Camp Meade, and the following orthopedic medical officers were serving:

Base Hospital.
Major J. W. Schirmer,
Lt. H. W. Wilam,
Lt. M. E. Harrell,
Capt. W. O. Markell,
Capt. A. G. Fuller,
Lt. Mickelthwaite,
Lt. H. K. Morrison,
Major R. W. Billington,
Lt. Charles H. Phillips.

Camp.
Capt. Dean S. Ince,
Capt. C. A. Cahn,
Lt. C. C. Nohe.

Camp Gordon, Ga.

During the mobilization period, an important orthopedic service was maintained at Base Hospital, Camp Gordon, under the charge of Captain Oscar Miller, who afterwards became camp inspector for this district. He was followed by Captain Jacobson and Captain Sanford, the latter assuming charge of the fracture cases. The base hospital at Camp Gordon has not been utilized for overseas cases until recently. On April 1st there were 506 overseas patients. Lieut. C. M. Turschel had been conducting the service admirably since Captain Sanford's transfer, and with the advent of the overseas cases, Major E. V. Kellar was assigned here also on April 1st.

The following orthopedic medical officers were serving on the orthopedic staff of this hospital in April:

Base Hospital.
Lt. Chas. M. Turschel,
Major E. V. Keller.

Camp.
Lt W. W. Beck.

Camp Custer, Mich.

The base hospital at Camp Custer has been almost a model base hospital under the extremely able administration of Colonel Irons. The orthopedic work here has been under the charge of Capt. Mercer, to whom all fracture cases as well as most of the bone and joint cases, have been referred. An excellent organization has been worked up in close coöperation with the general surgical service. The overseas cases have now been transferred to general hospitals, and the base hospital made a camp hospital. Before this change there had been over 500 overseas patients here. Captain Mercer has been assigned to Ft. Sheridan.

In April the following medical officers were serving on the orthopedic service at this hospital:

Base Hospital.
Lt. C. R. Crutchfield,

Camp.
Lt. R. H. Baker,
Lt. Carroll S. Thomas,
Lt. J. D. Blackburn.

Camp Grant, Ill.

The hospital is of almost the same size as the base hospital at Camp Custer. Overseas cases have also been received. No orthopedic service here, as distinct from the general surgical service, has been conducted, but Captain George Astley has had charge of the orthopedic work and has been extremely busy as consulting and operating surgeon. Recently he has been made chief of the surgical service, and several orthopedic surgeon assistants have been sent him. On April first there were 586 overseas patients at Camp Grant, and the following medical officers were on duty:

Base Hospital.
Capt. Geo. M. Astley,
Lt. Spencer P. Blim,
Lt. N. F. Crowe,
Lt. C. B. Young,
Lt. R. C. Wolfe,
Lt. J. B. Fitt.
Capt. Edward Jelks.

Camp.
Lt. E. N. Fischer,
Lt. E. O. Swanson,
Capt. H. W. Long.

Camp Sherman, Ohio.

The base hospital at Camp Sherman has had an active service during the mobilization period and has been designated to receive overseas cases as well. It has developed a very active section at first under the charge of Captain Powers, and later under the charge of Captain Chollett. Captain Chollett has had experience in both England and France and is extremely well qualified to care for a large bone and joint section. On April first there were 1076 overseas cases at Camp Sherman. The following men were serving on the orthopedic service of this hospital in April:

Base Hospital.
Lt. N. J. Koztracwzki,
Capt. H. C. Saltzstein,
Capt. John W. Powers,
Capt. Burt G. Chollett,
Lt. W. J. Fenton,
Capt. J. Roscoe Harry,
Lt. William Moncure,
Capt. U. P. Horger.

Camp.
Lt. H. J. Feaster,
Lt. C. L. McNeil,
Lt. J. C. O'Neill,

Camp Taylor, Ky.

The Base Hospital, Camp Taylor, has only recently developed a separate orthopedic service. Major E. A. Coleman, exempted to the section of orthopedic surgery, has been made chief of the surgical service, and Captain E. B. Mumford, who has had a year's foreign service in the orthopedic division, is acting as orthopedic surgeon. The number of overseas cases is large and the importance of bone and joint work is unquestioned. Major Codman's interest in bone and joint cases and his wide experience in bone and joint surgery are a great asset to the service. A very close liaison is being worked out between

the orthopedic convalescent cases in which joint function must be increased and the reconstruction activities. Careful records are taken of the weekly progress in joint motion. The work assigned is specially planned for the restoration of function.

On April first, there were 834 overseas cases at Camp Taylor. The following medical officers were serving on the orthopedic service at this hospital in April:

Base Hospital.
Capt. T. A. Bryan,
Lt. H. E. Powers,
Major E. A. Codman,
Capt. J. B. Young,
Capt. Louis H. Mayer,
Capt. E. B. Mumford,
Lt. F. N. Potts,
Capt. T. H. Stewart,
Capt. O. P. Hodge.

Camp.
Lt. Geo. E. Lyons,
Lt. James L. Shoemaker,
Lt. E. L. Heakel.

Fort Riley, Kansas.

At Base Hospital, Fort Riley, Major Napier was assigned early in the mobilization period and continued in this capacity until the latter part of August, 1918. He was then replaced by Major Mark Rogers, who developed a most useful service in connection with the large numbers of overseas cases which began to be sent home. Upon Major Mark Rogers' discharge from the service, he was replaced by Major Hobby, who had formerly been stationed at Camp Funston. Major Dickson, after a year's experience in Europe, has now been assigned to the base hospital at Fort Riley and brings to the service a great ability and splendid training.

On April 1st there were 476 overseas patients in this hospital, and the following orthopedic officers were serving:

Capt. Edw. Adams,
Capt. W. M. Holtz,
Major F. D. Dickson,
Capt. Marion Trueheart.

Camp Upton, N. Y.

The base hospital at Camp Upton has been receiving overseas cases for several months, and the orthopædic service has been ably conducted by Captain H. B. Thomas of Chicago. On April 1st there were 778 overseas cases at the base hospital, and the following medical officer personnel was serving on the orthopedic staff:

Base Hospital.
Capt. H. B. Thomas,
Lt. Alfred H. Yason,
Lt. Lysander S. Kemp,
Lt. Wm. H. MacKay,
Capt. C. M. Allaben,
Lt. E. A. Spies.

Camp.
Capt. J. C. Davis,
Lt. Chas. S. Bergman,
Lt. Horace H. McCoy,
Lt. Nathan Rosenberg,
Lt. Gerard J. B. Schoot,
Lt. Geo. L. Venable.

Camp Lee, Va.

At the base hospital at Camp Lee, near Petersburg, Va., the surgical service under Major Parker has been excellently organized and the orthopedic section has functionated efficiently under Capt. Wheeden, Major Jerrauld and several assistants. A good *esprit de corps* exists, and overseas wounded have done excellently well. On April 1st there were 419 overseas cases at the base hospital, and the following orthopedic surgeons were on duty:

Base Hospital.
Capt. A. A. Weeden,
Lt. Hugh I. Battey,
Capt. A. A. Fenton,
Lt. W. W. Tracey.

Camp.
Lt. E. B. Buchanan,
Lt. M. E. Simmons,
Lt. John D. Gillis.

Camp Dodge, Iowa.

Camp Dodge has been an active mobilization and demobilization centre, near Des Moines, Iowa. At the base hospital, even before overseas cases were sent here, Major Test organized an orthopedic section which was kept very busy and served most usefully. With the advent of our overseas cases assistants were sent. Lieut. Wolcott, fresh from very extensive bone and joint experience overseas, both in England and France, was placed in charge of most of the bone and joint operative work, which he handled with much skill. Lt. Colonel Orr has now been made consultant at the base hospital, with Major Durham as orthopedic surgeon.

On April 1st there were 616 overseas cases at the base hospital and the following orthopedic medical officer personnel were assigned to Camp Dodge:

Base Hospital.
Major F. C. Test,
Lt. T. A. Willis,
Lt. T. S. Mark,
Lt. W. E. Wolcott,
Capt. E. D. Wise,
Major H. A. Durham.

Camp.
Capt. W. G. Bouse,
Lt. R. M. Baker,
Lt. L. K. Strate.

Camp Shelby, Miss.

At the base hospital at Camp Shelby, there has never been a large number of overseas cases, but the orthopedic service there has been well conducted by Lieut. L. F. Carlton. On April 1st there were 139 overseas cases.

Ft. Sam Houston, Texas.

The department base hospital at Ft. Sam Houston, Texas, has been nearly as important as a General Hospital during the early stages of the war. Major Ansel G. Cook has been stationed here almost since its opening, and his skill in handling the foot conditions has been greatly appreciated. Major A. R. Colvin was stationed here for several months before his transfer to Ft. McHenry, where he has been chief of the surgical service. For the last few weeks, Capt. J. T. O'Ferrall has been made orthopedic surgeon and has helped materially with the bone and joint operative cases. On April 1st there were 262 overseas cases. The following orthopedic surgeons were serving at this base hospital in April:

Capt. G. H. Applewhite,
Lt. R. J. Wharton,
Lt. Robert F. Patterson,
Capt. F. B. Hudson,
Capt. John T. O'Ferrall,
Capt. J. H. Shelton.

Camp Bowie, Texas.

Only a comparatively small number of overseas cases have been sent to the base hospital, Camp Bowie, but many of these have been important and an orthopedic section of the surgical service has been maintained. Recently Capt. Wm. C. Duringer has been orthopedic surgeon and in April Major Pinneo was assigned to the service. His overseas experience should make him capable of being of great assistance with the operative bone and joint work. In April there were 335 overseas cases in this hospital, and the following medical officers were serving on the orthopedic staff:

Base Hospital.
Capt. Wm. C. Duringer,
Major Frank W. Pinneo,
Capt. G. W. Day.

Camp.
Lt. Kent A. Bowman.

Camp Pike, Ark.

The base hospital at Camp Pike has had a small overseas surgical service, and an orthopedic section. Captain Charles H. Sanford became orthopedic surgeon, transferred here from Camp Gordon, and was afterwards made Chief of the surgical service, being replaced by Captain W. S. Roberts. Recently Fred H. Hodgson has been transferred to this port because of his wide overseas experience in the treatment of bone and joint conditions. On April 1st there were 250 overseas patients in this hospital, and the following medical officers were assigned to the orthopedic service:

Base Hospital.	Camp.
Lt. E. D. King,	Lt. J. W. Gordon,
Capt. Chas. H. Sanford,	Lt. Henry R. Leibinger,
Capt. W. S. Roberts,	Capt. Homer Sylvester.
Major Fred Hodgson.	

Camp Lewis, Washington.

The orthopedic service at Camp Lewis, both in the base hospital and in the camp, has always been active. Originally, Major E. A. Rich organized the work and after he was made camp inspector, the service at the base hospital was taken over by Captain Harding, whose successful conduct of it deserves special mention. No large numbers of overseas cases have been sent here, but the work has been extremely high grade. On April 1st there were 249 overseas cases in this hospital.

The following men were assigned to the orthopedic service at the base hospital at Camp Lewis in April:

Base Hospital.	Camp.
Major Maynard C. Harding,	Capt. John Carling,
Lt. Sherman Rodgers.	Lt. Geo. E. Lindow,
	Lt. Doxey R. Wilson.

This entirely inadequate and brief summary of the main activities of the Section of Orthopædic Surgery may suggest that an attempt has been made to meet some of the obligations of the specialty. Little has been said of the devoted and unspectacular work of the orthopædic medical officers assigned to camp work. Their original careful examinations of the draft cases and their later important services on discharge boards may seem to have passed unnoticed, but this is not so. It has been generally recognized as necessary and important by the Division Surgeons. If, in the treatment of the wounded soldiers, the attention of the surgeons has been directed to the importance of combining the conservation of function with the treatment of the wound itself, a service to surgery as well as to the soldiers may have been rendered.

Book Reviews

Prosthesis of the Lower Limbs. F. MARTIN. P. Masson et Cie., Paris, 1918.

Early in 1916 when the surgery of the Belgian Ambulance de l'Ocean at La Panne began to be divided up into specialties under the direction of Lieut.-Col. Depage, Dr. Martin was assigned the problem of prothesis. The present comprehensive monograph is the outcome of his work.

Part 1 deals with provisional prosthesis. In a general consideration of the subject the author states that before the war amputation cases were so few that surgeons were little concerned with them, but the large number of them occurring now renders the problem very important. Provisional prosthesis was not practised at all before the war, but has become necessary now to get the patients to moving about without crutches as soon as possible, to hasten their convalescence and improve their morale.

A provisional member must be worn on a stump which is sensitive or even painful, and must therefore be so adjusted as not to cause irritation, and must be capable of adjustment to follow the change in size and shape of the stump. A temporary leg should be applied to a leg stump in about eight days and to a thigh stump in about four weeks. No pressure or even contact should come on the end or lower part of the stump. The weight of the artificial limb either for a leg or thigh should not exceed five pounds.

Apparatus for Amputation of the Thigh. This consists of two parts: The plaster mold which fits the stump and the wooden pilon extending to the ground. The mold is made by placing the patient on a table lying on the side of his good leg and applying plaster bandages around the stump and well up over the pelvis. A reinforcement of wire trellis is placed under the ischium and an iron hook incorporated in the outer side at the level of the great trochanter. After several layers of bandages have been applied the two branches of the pilon (the two parts of a crutch serve well) are laid on, one along the inner and one along the outer side of the stump, and the remainder of the plaster applied over them, incorporating them firmly into the mold. When it has set, the mold is trimmed around the top at the level of the posterior superior iliac spine a little below Poupart's ligament and well above the gluteal fold. It is then removed.

After the plaster has dried for twelve hours the lower ends of the branches of the pilon are brought together and fastened to a solid block or cylinder of wood placed between them with a heavy rubber tip on the end. A spreader similar to that used in an ordinary crutch is fastened between the branches of the pilon up near the plaster portion. The finished apparatus is held on the stump by means of a webbing sling passing over the opposite shoulder and under the transverse spreader

of the pilon, and a second strap passing around the pelvis and under the iron hook at the outer side of the plaster. For cases in which the stump is less than ten centimeters in length, the iron hook which is incorporated in the plaster is made longer, its vertical part extending down and curving under the lower end of the plaster mold, thus making a firmer attachment for the pilon. Disarticulations at the hip joint require a higher trimming of the plaster, otherwise the apparatus is the same as that for the very high amputations.

Apparatus for Amputations of the Leg. Here special attention must be given to keep the knee mobilized. It is an accepted axiom that in amputations below the knee the patient must never walk with the knee flexed when it is possible to recover its mobility. The provisional leg is made by molding a plaster shape over the stump, incorporating in it two upright iron bands one on each side, which terminate below in a wooden block with rubber base, and above in a joint at the level of the knee to which is hinged two more uprights of iron riveted to a leather cuff encircling the thigh. Should the stump be less than fifteen centimeters long it will be necessary to extend the plaster part of the apparatus up to the level of the knee anteriorly to prevent its swinging forward on extension of the knee, and in some cases it will be necessary to hold it on by means of a webbing strap over the opposite shoulder.

All the above applies to provisional prosthesis. The second part of the monograph deals with definitive or permanent prosthesis.

The parchment-covered papier-maché or wooden artificial limbs with joints, which were little known in Europe before the war, are credited by the author to America. The ancient wooden legs were not fitted to the stump and little attention was paid to the support. The Beaufort leg was somewhat better since it was molded to the stump, but it was not planned on anatomical or physiological lines. The American type, while theoretically ideal, has many practical difficulties. The Belgian type includes the following principles: (1) Careful shaping of the stump to furnish good support; (2) reproduction of the anatomical form of the natural leg; (3) restoration of the normal statics; (4) provision for the same passive motion as that of the natural leg. Wood is used in construction of the apparatus in preference to metal or other materials because it has more advantages and fewer disadvantages than other substances. For interior finish a good layer of varnish is better than any kind of cloth or celluloid. The wood used in the making of the apparatus must be well seasoned. Some trouble was experienced from the use of unseasoned wood when the extensive manufacture of artificial limbs exhausted the supply of dry wood. The large thigh pieces cracked and warped. For this same reason it is necessary to have the dry wood of the apparatus covered with waterproof varnish or other dressing. Some of the American types of legs have a mechanism for the automatic propulsion of the leg on walking. This is something none of the other makes possess. The essential part of this is a spring (or elastic) which is put on tension when the leg is flexed and causes extension of the knee after the flexing force is re-

moved, provided the flexion is not more than forty-five degrees. If flexion is made to ninety degrees (as in sitting down) the same elastic, owing to the change in relative position of the points of attachment, maintains the flexion instead of returning the leg to extension. The long axes of the segments of the American leg are neither anatomical nor physiological. The upper and lower segments are aligned on an exact vertical axis and the axes of the knee and ankle joints are parallel with each other and with the floor. In the normal leg the axis of the femur and of the lower leg make an obtuse angle opening outward at the knee, and the plane of the ankle joint slants downward externally. Moreover, the long axis of the normal foot does not make a right angle with the axis of the ankle joint as it does in the American artificial leg. When a patient walks with such a leg his gait is asymmetrical because the artificial leg does not swing in the same angles as the real leg. This is conclusively demonstrated by cinematograph pictures obtained of walking patients. For this reason the gait is difficult and ungainly.

In the designing of the Belgian artificial leg it was the intention to overcome these defects. In the first place an accurate and practical method of determining the proper length of the leg was devised. The question of relative length as compared with the sound leg was settled as follows: Legs with immobile knees should be two to three centimeters shorter than the sound leg; those which have a knee joint capable of ninety degrees flexion should be the same length as the real leg. For making the measurements the patient is placed against a vertical frame with projecting markers to steady the shoulders, head, and hips, and a shelf for the stump to bear upon. Measurements are then taken to the floor from (1) the perineum, (2) the lower surface of the stump, (3) the internal condyle, and (4) internal malleolus of the real leg. With the patient in the same position a tracing is made on a sheet of paper fastened to the frame to record the outlines, both frontal and sagittal, of the sound leg. This tracing, reversed, serves as an accurate guide, together with the measurements, for the shape and angulation of the artificial leg. It is placed on the work table perpendicularly and the plaster mold of the stump hung in front of it so that the outline of the mold conforms to the tracing. A pilon with a solid wood block at the knee and another at the ankle serves as framework around which the lower leg is modeled in clay, conforming accurately to the tracing. The permanent leg is made over the entire model by gluing successive layers of thin strips of wood over it. These are laid longitudinally, spirally, and circularly alternately until fifteen to twenty layers are applied. When the water-proof glue is well dried the inner mold of clay and plaster is removed. There remains the making of the knee and ankle joint and the coupling of the segments. The knee axis should be posterior to the center, so that three-fifths of the diameter of the leg is anterior to it. The lateral plane is determined by drawing a line touching the lower end of each condyle as indicated on the tracing. The knee joint is provided with an automatic extension apparatus consisting of an elastic cord attached

to a shorter lever on the axle inside the leg. It is so set that on full flexion its force is exerted in the opposite direction, thus maintaining the flexion. The location and plane of the ankle joint is determined with the same care as the knee joint. A line drawn from it to the ischial support should pass in front of the knee joint. The joint is capable of lateral motion by virtue of the disposition of the axle which is in two parts set at an angle with each other. The foot is made of wood and conforms to the real foot in shape and in its points of support at heel, outer border and head of first metatarsal.

Pictures by cinematograph of a patient walking with the Belgian artificial leg show that the swing and joint motion is the same as that of the real leg.

For amputations below the knee a mold is made of plaster in the same manner as for a thigh stump, care being taken first to cover the prominent lead of the fibula and to pad the end of the stump so that no pressure will be made on those parts. The permanent leg is fashioned over the positive model by gluing successive layers of wooden strips over it as described above. It is made to conform to the outlines of the real leg and is provided with a wooden foot attached through an ankle joint as described above. Leather or canvas straps passing over the opposite shoulder serve to hold the leg on.

If the stump is less than eight centimeters long the apparatus should consist of a combined leg and thigh piece. It is so fitted that the main support comes on the ischium and the tibial stump bears no weight. For low amputations of the leg, however, provision is made for terminal weight bearing. The leg is fenestrated in front along the lower part of the tibial stump and is so shaped that part of the weight comes along the sides of the stump and part on the end.—*William Arthur Clark.*

Gun-Shot Fractures of the Extremities. JOSEPH A. BLAKE. Paris: Masson & Cie., 1918.

Dr. Blake's book is very concisely written, quite plain in its description of apparatus, and shows the radical change in our ideas regarding the treatment of both open and closed fractures which has taken place during the war. Some of the apparatus has been simplified since the book was written, but still the idea and the principle behind most of the treatment remains the same. Our more cumbersome form of immobilization and support has given way to more open work, frames, and increasing use of traction and support through weights.

It should be borne in mind that in septic cases, pus may burrow up to the body from a limb elevated too high, just as it can burrow down a dependent limb. This form of treatment with weights and pulleys needs constant supervision, as Dr. Blake points out.

On the whole, the illustrations and descriptions are well worth studying.

Orthopaedic Society Meeting

PRELIMINARY PROGRAM OF THE THIRTY-THIRD ANNUAL MEETING OF THE AMERICAN ORTHOPEDIC ASSOCIATION.

Atlantic City, Hotel Chalfonte, June 14, 16, and 17, 1919.

ANNOUNCEMENT.

It seems best to the Program Committee to limit the program to a few subjects of timely interest. From the list here given of those already offered, and from those still to be received, selection will be made for the final program, which will be ready about June 1st.

Sunday will be an important day. There will be a rally, at which Dr. J. E. Goldthwait will speak, and probably an adjourned business meeting, as there are many matters of importance to discuss.

E. G. BRACKETT, *Chairman*,
Surgeon-General's Office, Washington, D. C.,
DAVID SILVER,
E. W. RYERSON,
Program Committee.

LIST OF SUBJECTS.

PRESIDENT'S ADDRESS.
H. P. H. Galloway, M.D., Winnipeg, Canada.

SURGERY OF JOINTS.

The Primary Suture of Joint Wounds. W. S. Baer, M.D., Baltimore, Md.
Arthroplasty of the Elbow. W. R. MacAusland, M.D., Boston, Mass.
Quiet Hip Disease. Henry Ling Taylor, M.D., New York City.

SURGERY OF BONES.

(a) Fractures.

Points to be Observed in the First Ten Days of the Treatment of Compound Fractures. H. Winnett Orr, M.D., Lincoln, Neb.
Treatment of Ununited Fractures Following War Injuries.
Frederick C. Kidner, M.D., Detroit, Mich.
The Restoration of Loss of Bone in Gun-shot Injuries.
Fred H. Albee, New York City.
Personal Experiences with Lane's Plates in Fractures.
Paul P. Swett, M.D., Hartford, Conn.
Treatment of Fracture of the Surgical Neck of the Humerus.
Frank E. Peckham, M.D., Providence, R. I.

(b) General Bone Affections.

Xanthoma of the Tarsus: Report of a Case and Review of the Literature.
Charles F. Painter, M.D., Boston, Mass.
Shortening of the Long Leg: With Report of a Case.
Aurelius R. Shands, M.D., Washington, D. C.
Non-union Following Corrective Osteotomies of the Tibia: Report of Two Cases.
Emil Geist, M.D., Minneapolis, Minn.
Transplantations of the Fibula. W. C. Campbell, M.D., Memphis, Tenn.

SURGERY OF PARALYSIS.

(a) Peripheral Nerves.

Diagnosis and Pre-operative Treatment of Peripheral Nerve Injuries.
Murray S. Danforth, M.D., Providence, R. I.
Treatment of Peripheral Nerve Injuries. Frederick C. Kidner, M.D., Detroit, Mich.
Results of Tendon Transplantation in the Treatment of Old Nerve Injuries.
Clarence L. Starr, M.D., Toronto, Canada.
Conditions Aiding in the Diagnosis and Prognosis.
Sydney B. Cone, M.D., Baltimore, Md.

(b) General Surgical Problems.

Operative Treatment of Paralytic Conditions of the Upper Extremities.
Arthur Steindler, M.D., Iowa City, Iowa.
Tenoplasty of the Hand. R. T. Taylor, M.D., Baltimore, Md.
Stabilization of the Ankle for Paralytic Deformities of the Feet.
Michael Hoke, M.D., Atlanta, Ga.
The Loop Operation for Paralytic Talipes Valgus, with Remarks on the Principles of Operative Treatment for Paralytic Deformities of the Foot.
Royal Whitman, M.D., New York City.
Certain Special Aspects of the Treatment of Infantile Paralysis.
Robert W. Lovett, M.D., Boston, Mass.

RECONSTRUCTION PROBLEMS.

(a) Military.

Type of Deformities Following Bone and Joint Injuries and the Treatment of Late Deformities. G. W. Hawley, M.D., New York City.
Early Occupational Therapy in the Treatment of Deformities and Other Conditions. A. H. Freiberg, M.D., Cincinnati, Ohio.
Practical Application of Occupational Therapy in the Hospital.
E. B. Mumford, M.D., Indianapolis, Ind.,
H. C. Marble, M.D., Boston, Mass.

(b) Industrial.

Disability Periods as a Result of Injury to the Back.
James W. Sever, M.D., Boston, Mass.
The Industrial Rehabilitation of the Cripple.
Charles H. Jaeger, M.D., New York City.
Preventive and Prophylactic Orthopædic Practice.
Charles L. Lowman, M.D., Los Angeles, Calif.

FOCAL INFECTION.

Infectious Arthritides, with Especial Reference to the Foci of Infection.
Virgil P. Gibney, M.D., New York City.
Pathogenesis and Treatment of Affections Following Injuries or Infections of the Extremities. Philip W. Nathan, M.D., New York City.
Bone and Joint Lesions from Focal Infections.
Stewart L. McCurdy, M.D., Pittsburgh, Pa

Current Orthopaedic Literature

Numerals at head of each abstract are for use in connection with the official "Classification of Orthopædic Literature," published in the JOURNAL for January, 1917, reprints of which are obtainable from the JOURNAL office.

II. CARE OF CRIPPLES.

II, 2.

CRIPPLED CHILD—ITS PHYSICAL AND EDUCATIONAL NEEDS. A. E. Horwitz. *Missouri State Medical Association Journal.* January, 1919.

The author makes a plea for the establishment of a special municipal hospital for the treatment of orthopedic cases. There are 700 crippled children in St. Louis out of school at the present time. These children should be divided in the following groups:

1. Those with active disease who cannot properly be transported to school.
2. Those with active disease who can be transported.
3. Those who could travel unattended were proper provision made for their comfort while at school.
4. Strictly hospital cases.

For Class 1, the author advocates the establishment of a Hospital School where the physical and mental requirements can be cared for simultaneously.

For Classes 2 and 3, the establishment of a special school is advocated. Special seat should be provided children wearing apparatus to enable them to keep their minds with comfort on their studies.—*Edward Z. Holt, Atlantic City.*

III, 5.

AN ARTIFICIAL SYNOVIAL FLUID. Robert T. Morris. *Surg., Gynec., and Obstet.,* March, 1919.

Boroglycerine ounces 1, glycerine ounces 3, normal saline solution, ounces 4. After breaking up the adhesions in chronic inflammation of fibrous structures, the joint is injected full of the fluid. It acts in two ways, being retained in the joint from several days to a few weeks:

1. It is a hygroscopic fluid resembling normal synovial fluid; it furnishes a benign lubricant which offers a resistance to the reforming adhesions.
2. As an hygroscopic fluid it has a tendency to unload interstitial infiltrates from the fibrous tissue surrounding the joints when congested from chronic inflammation.—*Leo C. Donnelly, Detroit.*

III, 7, *b,* and XIX, 1.

INJURIES TO FINGERS. W. K. Hughes. *Medical Journal of Australia,* December 7, 1918.

This article describes the repair of an injury to a tendon of the finger. The author strongly urges the abolition of all scar tissue in order to prevent adhesions and to avoid sepsis. Scars from war wounds are unusually deep and include many pockets of septic material. The procedure in an isolated case is described. After the injured surface has been covered with good skin, an incision is made lateral to the tendon over the site of the injury. The tendon is carefully dissected above and below the injury for a considerable distance. It may be necessary to follow adhesions to the wrist or above it. The

tendon should be sutured with fine sutures. The finger should be gently moved the day following the operation.—*Edward Z. Holt, Atlantic City.*

III, 7.

OPERATIVE TREATMENT OF GUNSHOT WOUNDS OF THE SPINE WITH GRAVE PARALYSIS. Harold Neuhof. *Jour. A. M. A.*, Jan. 4, 1919, p. 37.

It is the belief of the writer that there is a proportion of the cases of gunshot wounds of the spine in which neither the cord nor the dura is injured, and that in these cases even with grave paralysis there is a probability of an oedema being the main element in the lesion. Four illustrative cases are reported.—*E. S. Hatch, New Orleans, La.*

IV. RESEARCH IN BONE GROWTH AND REGENERATION. SKELETAL ANATOMY AND PHYSIOLOGY.

IV, 1.

SPUR-LIKE FORMATION OF BONE FOLLOWING AMPUTATION. J. D. Morgan. *Arch. Radiol. and Electrotherap.*, 1918, xxiii, 154.

Article based on 250 personal cases of author at Granville Canadian Special Hospital at Ramsgate, and No. 15 Canadian General Hospital at Taplow. It describes the x-ray picture of healthy amputation stump showing bone rounded off clean, surrounded by a fairly uniform shadow of soft parts. Some bone atrophy may have occurred or a small amount of periosteal thickening may be present.

The majority of cases studied by the author showed irregularities in the end of the stump due to new bone formation, this varying from a small spicule to a relatively large wing, the majority of the spurs extending upward. They were frequently associated with pain and discomfort and also were the cause of persistent discharging sinuses. Re-amputation was necessary in many cases. The causes are probably operation by inexperienced operators, septic wounds, severe fatigue due to long transportation with infrequent dressings. As preventive measures the following are mentioned: The Bier treatment, the osteoplastic flap, the sub-periosteal and aperiosteal methods. A properly performed amputation, a clean wound and early weight bearing generally preclude the possibility of spur formation. —*Leo C. Donnelly, Detroit.*

V. TUBERCULOSIS.

V, 2, *a*.

SURGICAL TREATMENT OF POTT'S DISEASE. P. A. McIlhenny. *New Orleans Med. and Surg. Jour.*, Dec., 1918.

The author advises surgical treatment only in those cases of Pott's disease which cannot be cured by conservative treatment with a possibility of some motion, and the cases operated on should fall between early adolescence and middle age. When the disease has progressed far enough to cause marked deformity or paralysis, operations should then be resorted to. The Albee technique has been used by the writer.—*E. S. Hatch, New Orleans.*

VII. OSTEOMYELITIS.

VII, 2.

ACUTE OSTEOMYELITIS IN CHILDREN. A. C. Wood. *Pennsylvania Medical Journal*, December, 1918.

The subject is dealt with in minute detail, going carefully into the symptomatology and diagnosis of this conditon.

Early operation is advocated where possible.

There is nothing especially new brought out.—*A. G. Nichol, Nashville.*

X. CONGENITAL ABNORMALITIES (OTHER THAN DISLOCATIONS).

X, 3.

A Case of Congenital Radio-Ulnar Synostosis. Jonas C. Kopelowitz. *Jour. A. M. A.*, Jan. 4, 1919, p. 21.

One case is reported in which the x-ray showed intimate bony union of the upper six centimeters of the radius and ulna; both forearms were identical.—*E. S. Hatch, New Orleans, La.*

XII. CHRONIC INFECTIONS OF JOINTS AND BURSÆ (NON-TRAUMATIC).

XII, 7.

Mechanical Derangement of the Knee Joint. M. S. Henderson. *Journal-Lancet*, 1918, xxxviii, 523.

In this paper the principal conditions discussed are: (1) displaced semilunar cartilages, and (2) osteocartilaginous bodies of the knee joint. The anatomical basis for the frequency of the displacement of the internal cartilage is found in the intimate association between the inner body of this cartilage and the strong fibres of the internal lateral ligament and capsule to which it is attached. Any tension of the capsules tends to displace the cartilage. Some of the fibres of the quadriceps are inserted rather low down on the inner side of the capsule and this prolongation might pull in such a manner as to disturb the normal contour of the fibrocartilage. The anterior extremity is rather loosely inserted.

It is generally conceded that injury to the semilunar cartilage very rarely, if ever, occurs with the knee in full extension. When the knee is flexed to 150 degrees, the foot everted and rotated outward, the relaxed internal lateral ligament allows of some separation of the internal condyles from the internal tuberosity of the tibia. If the force continues with the foot in eversion, there is a tendency for the tibia to rotate outward on the femur, carrying with it the semilunar cartilage, and an attempt is made to extend the knee, the internal condyle of the femur rolls down on the anterior extremity of the cartilage and catches and holds it, and unless the cartilage slips from between the bones, it will be torn from its rather loose anterior moorings. If the rotation is considerable, the condyle of the femur may catch the cartilage rather far back and rip it longitudinally through its middle.

In certain cases the capsule may be so lax that the cartilage will slip out before severe damage is done. Pain, effusion, and disability will ensue. At operation the cartilage appears normal but too loose. Removal of the anterior three-fifths suffices.

With the first locking, a plaster of Paris cast should be applied, leaving it on six weeks. There will be few recurrences. In old cases, the loose ends of the cartilages may be palpated, there may be deposits of lime salts but, as a rule, the x-ray is only of advantage in ruling out osteocartilaginous bodies. The external semilunar cartilage should only be removed on a definite history of pain at the outer side of the joint in conjunction with distinct locking.

Next to internal semilunar cartilage, loose bodies have been the most frequent cause of derangement inside the knee joint. Foreign bodies are rare, but osteocartilaginous bodies are often found. They may be produced by (1) direct trauma knocking off a piece of the articular surface of the internal or external condyle of the femur or the patella, (2) osteochondrosis dessicans, (3) osteochondromatosis, (4) hypertrophic arthritis.

In osteochondritis dessicans, the end artery supplying the area probably becomes plugged, and the part becomes undernourished and sloughs off. The joint is unhealthy and a slight trauma tears off small fragments. Only two or three loose bodies are produced, and careful x-ray study usually shows a flattened area on the internal condyle.

In osteochondromatosis there is an associated synovitis, the lining is inflamed, somewhat thickened and pedunculated into teats. Some are fibrous and others are cartilaginous, becoming bulbous. They drop off, wander about the joint sac, and are nourished by the joint fluid. There are factors which suggest these to be of the order of new growths.

In older people, marginal osteophytic growths may break off in cases of hypertrophic arthritis and wander about the joint. A hypertrophic arthritis may follow loose joints in young people. A loose body or bodies produce catching or locking, with pain and effusion, followed by a period of rest, providing the body finds a resting place and is not caught between the articular surfaces.

Loose bodies in the joint demand removal after location by the x-ray. If only in the suprapatellar pouch, they may be removed under local anesthesia. A sharp cutting needle is thrust through the skin into the loose body, thus fixing it until one cuts down upon it. When the body is in the middle of the joint, usually near the internal condyles, the same incision is used as in removing the internal semilunar cartilage. If the entire compartment must be explored, the patella and lower fibers of the patella may be split longitudinally. Bodies in the posterior section may be worked through to the anterior section. If necessary, open the posterior compartment as a secondary operation. This is difficult in fleshy persons. Palpation within and without and the use of long forceps may be necessary.—*Leo C. Donnelly, Detroit.*

XVI. METABOLIC DISEASES AND DISEASES OF INTERNAL SECRETIONS.

XVI, 2.

OBSERVATION ON THE CAUSE OF RICKETS. Noel Paton, Leonard Findlay, and Alexander Watson. *The British Medical Journal,* December 7, 1918.

The authors, in the course of an investigation as to the cause of rickets, experimented on young dogs, and in this article come to the following conclusions:

Pups kept in the country and freely exercised in the open air, although they had actually a smaller amount of milk fat than those kept in the laboratory, remained free of rickets, while the animals kept in the laboratory all became rickety.

The observations seem to show that some other factor than diet is the prime cause of rickets in dogs and afford no evidence that milk fat (butter) contains any accessory factor protecting against the development of rickets. —*M. S. Henderson, M.D., Rochester, Minn.*

XVIII. STATIC AND POSTURAL DEFECTS.

XVIII, 1.

GOOD POSTURE. James F. Rogers, M.D. *New York Medical Journal,* January 4, 1919.

The author thinks that it is most unfortunate that the chief underlying cause of bad posture, that is fatigue, has not only been overlooked but actually scouted, and that, doubly unfortunately, by those who have preached the gospel of erectness.

In other words, instead of thinking that fatigue is produced by bad

posture, he is inclined to believe that the bad posture is produced by the fatigue, and that many of the children in school who assume bad posture are really undernourished and underdeveloped and the school seats and benches tend to further increase the bad posture.—*M. S. Henderson, M.D., Rochester, Minn.*

XVIII, 6.

FLAT FEET AND WEAK FEET. H. Scheimberg, M.D. *New York Medical Journal,* January 25, 1919.

The author is of the opinion that care should be taken in prescribing shoes and it should be done just as one would prescribe any medicine. He thinks that metal arch supports, particularly the commercial kind, are not good, and thinks that felt is a much better substitute. He favors muscle exercises as being a preventative of the development of flat feet.—*M. S. Henderson, M.D., Rochester, Minn.*

XIX. TRAUMATIC CONDITIONS.

XIX, 2, *a.*

A DEMONSTRATION OF THE ABDUCTION METHOD OF TREATING FRACTURE OF THE NECK OF THE FEMUR. Royal Whitman, M.D. *Pennsylvania Medical Journal,* December, 1918.

This subject is handled after the author's usual concise and lucid manner, bringing out the shortcomings of the ordinarily accepted line of treatment by traction. He points out the mechanical impossibility of accurately opposing the fragments of the fracture by this method.

The author shows that the abduction method, as devised by him, has a sound mechanical basis, and the practical application is as follows:

"The patient having been anesthetized, is placed on a pelvic rest provided with a perineal bar for fixation, the shoulders resting on a box of equal height, and the extended limbs being supported by assistants, who, by direct manual traction at the ankles, draw the patient firmly against the perineal bar. The assistant on the injured side continues the traction, at the same time rotating the limb slightly inward, while the surgeon lifts the thigh and guides the trochanter to its normal position.

When the displacement is completely reduced, as demonstrated by measurement, the two assistants simultaneously abduct the limbs, the one on the sound side slightly in advance of the other; in order to fix the pelvis and to demonstrate the normal individual range to which the injured limb must conform.

The typical attitude at the completion of the operation is full symmetrical abduction of the two extended limbs on a level pelvis with the landmarks on the two sides in exact correspondence. This assures adjustment and fixation; for, as has been stated, abduction places the fragments in the same plane, while the tension on the capsule which surrounds each must direct them toward one another, and finally exert mutual pressure. Meanwhile, the apposition of the trochanter and the base of the neck with the acetabular rim furnishes a second point of resistance to displacement, and the security of direct bony contact is further assured by the impotence of the muscles in full abduction. This is what is called anatomical or natural splinting, which is made effective by the attitude of the limb, an atittude that is maintained by a long plaster spica, extending from the axilla to the toes, applied in full abduction, full extension, and slight internal rotation."

The original dressing is retained for from eight to twelve weeks; after its removal the patient should be confined to bed until some voluntary control of the muscles is established.

During this period passive motion is used and weight bearing should not be allowed under six months.

The subject is well illustrated with roentgenograms, showing the various points of interest with reference to this condition.

The article is well worth consideration to those who are interested in this subject.—*A. G. Nichol, Nashville.*

XIX, 2, *a*.

FRACTURE OF CERVICAL VERTEBRAE WITH RESTORATION OF BONY SUBSTANCE. L. F. Luckie. *Journal of American Medical Association*, February 1, 1919.

Major Luckie reports the case of an aviator who was injured in a fall from an aeroplane. The patient lay in the post hospital for the treatment of injuries in other parts of the body and it was nearly six weeks before the broken neck was discovered, which does not seem to speak well for the army medical service at Gerstner Field.

Without further care he was allowed to go home on a thirty days' leave and spent most of that time going from one doctor to another in Richmond, Va., and Baltimore, Md. He then returned to the post hospital and came under Major Luckie's care. His head and neck were bent to the right and forward, and he suffered great pain. Roentgenograms showed fracture of the fourth, fifth, and sixth cervical vertebrae, the fourth being dislocated on the fifth.

Major Luckie constructed a modified jury-mast whose halter was supported by a perpendicular standard resting on each shoulder. The standards were adjustable, and by this means the head and neck were made to assume an erect position in the median line.

In due time the pain and much of the rigidity disappeared. The patient went back into the service and passed all the aviation tests in Class A.

The article is illustrated by some excellent photographs and about five nearly useless skiagrams.—*Harold A. Pingree, Portland, Maine.*

XIX, 2, *b*.

THE TRIANGLE SPLINT IN THE TREATMENT OF COMPOUND FRACTURES OF THE HUMERUS. Major Philip Turner, R.A.M.C. *The British Medical Journal*, December 28, 1918.

Turner advises the use of the triangle splint for the treatment of fractures of the humerus, with a modification provided for the elbow to be held in flexion by use of padded ring on the opposite shoulder and a band around the perineum on the affected side, and holds the splint firmly to the chest wall.—*M. S. Henderson, Rochester, Mass.*

XIX, 2, *b*.

"NO SPLINT" TREATMENT OF FRACTURES ABOUT SHOULDER IN HUMERUS AND ABOUT ELBOW. J. W. Dowden. *Edinburgh Medical Journal*, December, 1918.

The author claims to be able to treat a simple fracture of the humerus in such a manner that the patient returns to work in from six to eight weeks as joiner, a dentist, or a mill worker. In ten years' experience with this method the author claims to "have never been disappointed nor has there ever been a case of non-union or bad result." The action of the muscles as a distorting agent is ignored. The arm is placed to the side of the chest. A Sayre dressing is applied.—*Edward Z. Holt, Atlantic City.*